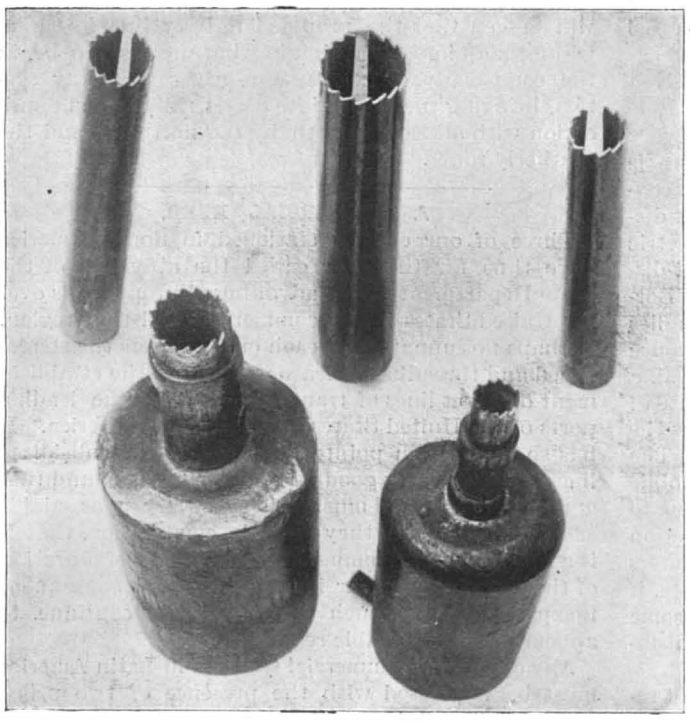
SCIENTIFIC AMERICAN

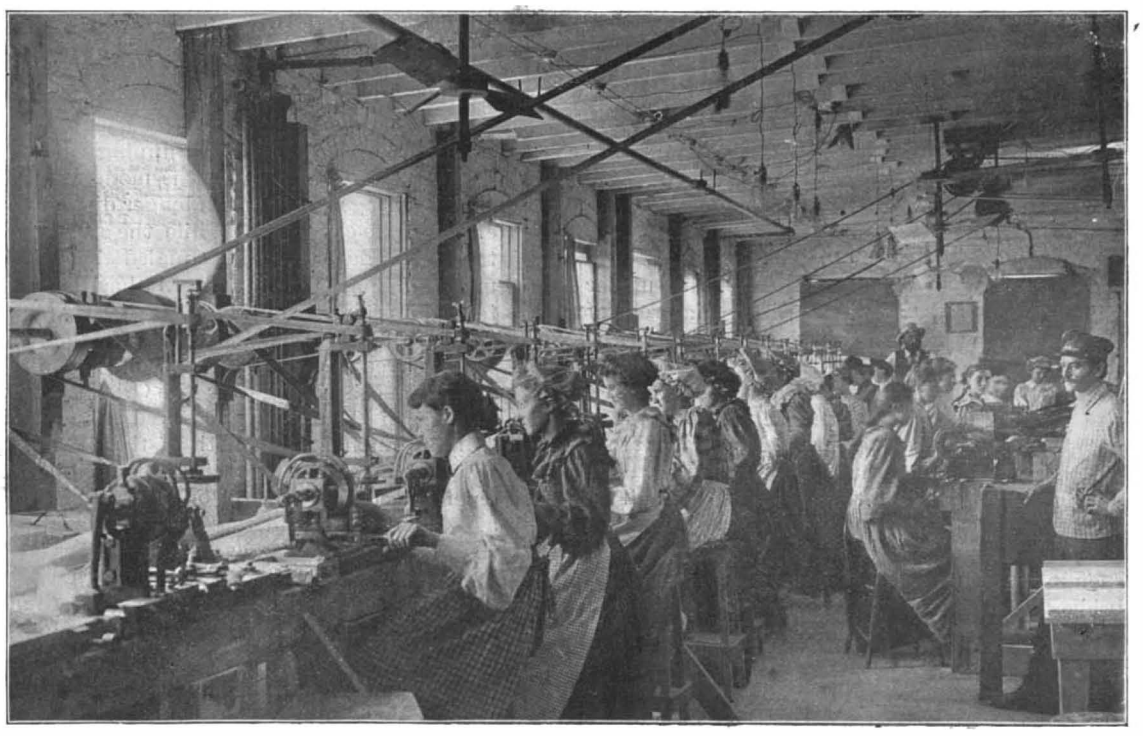
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1899, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXXI.—No. 6. [ESTABLISHED 1845.] NEW YORK, AUGUST 5, 1899. [$3.00 A YEAR. WEEKLY.

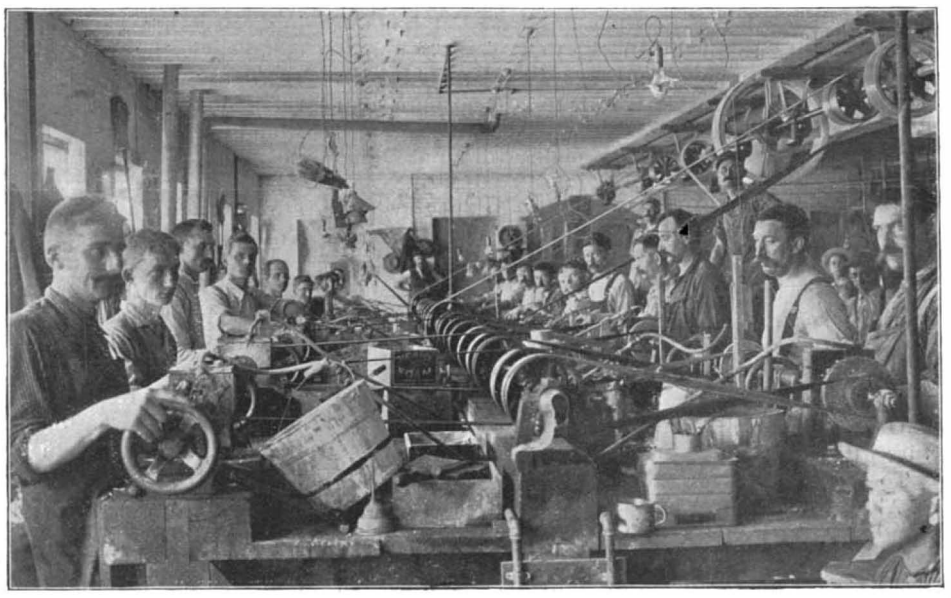


Saws and Saw Holders.



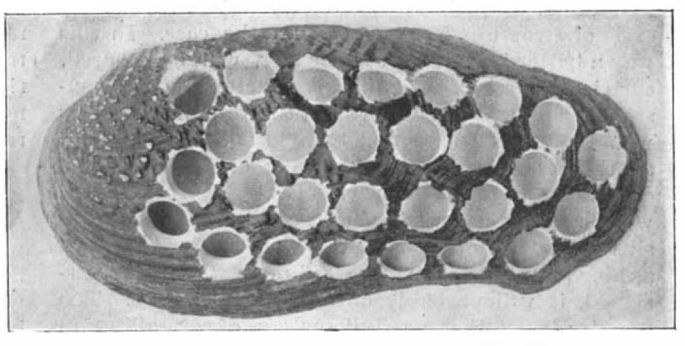
Grinding the Blanks.

Mussel Fishing through the Ice, Mississippi River.

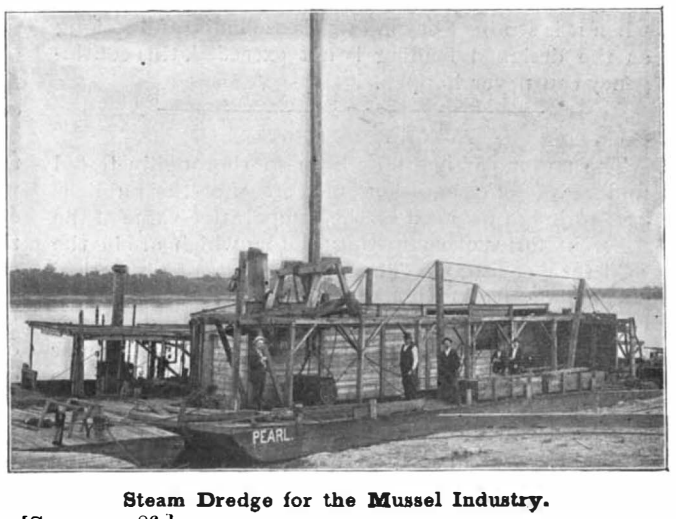


Sawing Rough Blanks for Buttons.

Drilling Holes in the Buttons.



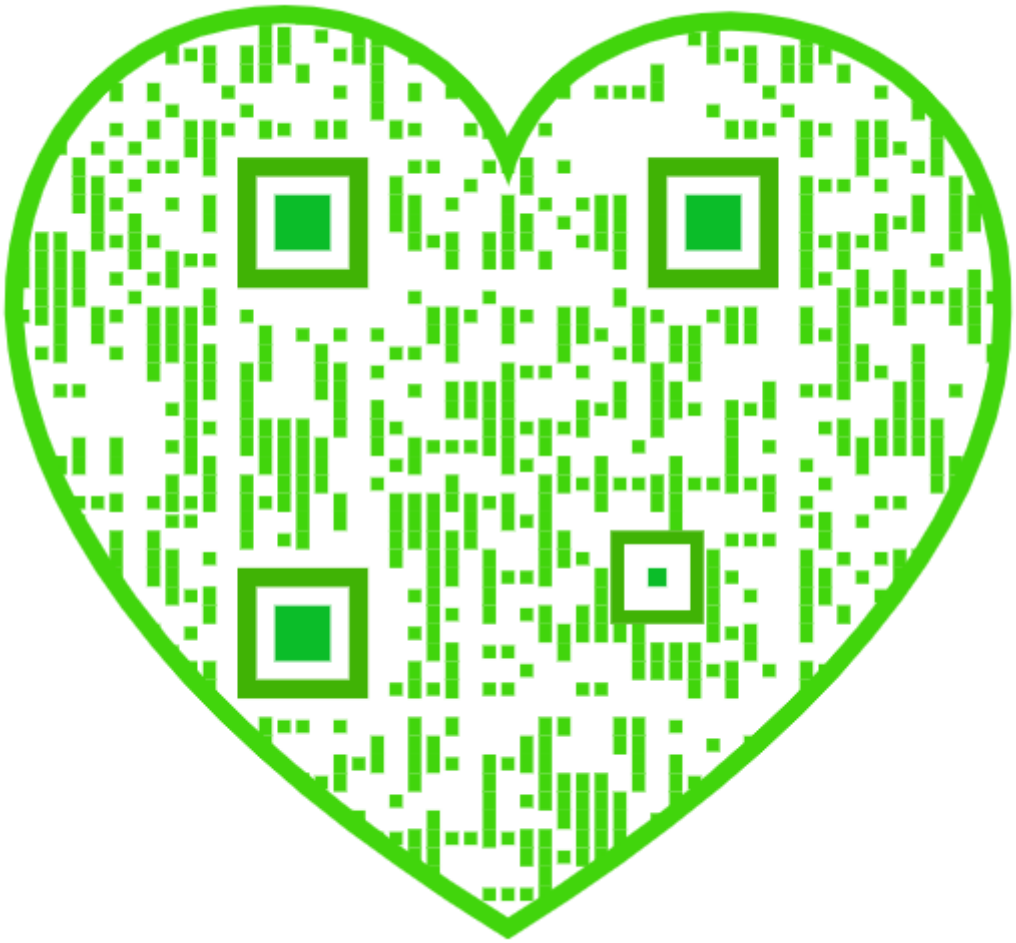
"Deerhorn" Mussel with Blanks Cut Out.



Steam Dredge for the Mussel Industry.

THE PEARL-BUTTON INDUSTRY OF THE MISSISSIPPI RIVER.—[See page 86.]

© 1899 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 5, 1899.

AVERAGE LIFE OF AN IRON OR STEEL BRIDGE.

A correspondent writes from one of the smaller New England towns to say that a proposed improvement in the shape of a $50,000 steel bridge is meeting with opposition from many of the citizens on the ground that the average life of such a structure is limited to twenty-five years, and, therefore, the benefits derived would not justify the expenditure. He wishes to know whether the stated term of life is correct. Without pausing to comment on the admirable and all too rare regard for the interests of posterity shown by the obstructionists in question, we hasten to assure our correspondent that their estimate of the length of life of steel bridges is altogether too limited. The permanence of a steel bridge will depend upon three conditions: the design, the loading, and the maintenance. If it be properly designed for a specified maximum loading; if oversight be exercised that this loading is never exceeded; and if the steel work is thoroughly accessible and painted at regular intervals, there is no reason why a bridge should not last for centuries. As a matter of fact, however, these conditions are too often ignored or imperfectly fulfilled. In the first place, although bridge designing should always be intrusted to a specialist, even if the structure is to cost no more than the sum named above, many of the county bridges and those constructed in the smaller towns are built from the designs (so-called) of the local surveyor, who may have the vaguest ideas as to the strains to which the various parts are to be subjected and the best way to proportion the different members and connect them into a finished structure. The construction also should always be carried out by a recognized bridge firm, for the local blacksmith or machinist's shop is usually no more fitted for building good bridges than it is for building lathes and locomotives. It is questionable whether amateur bridge building can produce a structure with a useful life of twenty-five years.

To secure the best results the county officers, Board of Aldermen, or whoever it is that has the matter in hand, should first determine exactly what uses the bridge is to be put to and the greatest possible loading to which it will ever be subjected. This information, together with the location and other data, should then be published for the benefit of the competing bridge companies, who should be given a free hand as to the style of structure best adapted to the case. In this way a better bridge, and a cheaper, will be secured, even in the case of insignificant structures, whose construction it might be supposed the bridge companies would not be at the trouble to undertake. When such a bridge is completed, the question of its life will be one of care and maintenance. If every inch of the steel work receives a periodical coat of the best non-corrosive paint, and care is taken that the bridge is not strained beyond the limit agreed upon when it was designed, it will probably outlast its usefulness. The popular belief that a subtile process of crystallization is slowly weakening the metal of all the bridges is a fiction, pure and simple. The metal can only lose its life when it is strained beyond its elastic limit, and so long as the designed loading is not exceeded, this contingency can never happen.

AUTOMOBILE MOTORS.

The motor car has now been so thoroughly tested under different conditions of work that the public is able to judge for itself of the comparative value of the different forms of competing motors which are in the field for recognition. The requirements of a practical automobile are so numerous and differ so widely, according to the service to which it is to be put, that it is at present impossible to pick out any particular type of motor and say that it is the best for every type of work. Not only does the service differ, but there is now, and will be yet more markedly in the future, a wide difference in the requirements of the user. The present indications are that certain types of motors will become identified with particular forms of service.

To-day the motors which are most in evidence and give the best promise of permanence are the electric, oil spirit, and steam motors, and those which are driven by compressed air. There seems to be a general impression that for passenger transportation in and around our cities the electric automobile is the best; although for private use its high cost is likely to restrict its use for some time to the wealthy. It has the great advantages of being silent, free from odor, simple in construction and gearing, capable of ready control, and having a considerable range of speed. Its objectionable features are its great first cost, the limited distance which it can run without recharging, and the necessity of operating it within easy reach of a charging station. At present it holds the record for speed. In a recent trial in France an electric automobile covered a distance of two kilometers at the speed of 65·6 miles per hour.

Rivaling the electric motor is the oil or vapor driven motor. As compared with the electrical automobile the first cost is less and the running expenses are very much lighter. The weight is moderate, and there is the advantage that a much longer distance can be covered for one charging. While the speed for short distances has never on trial equaled that of the electric motor, in long distance runs it has naturally out-distanced its rival. Thus, in the motor car race from Bordeaux to Paris of last May, the distance of 351 miles was covered at an average speed of 30 miles an hour; and in another race over the Orleans-Vierzu road, a distance of 60·2 miles was covered at an average rate of 35 miles an hour. In both of these competitions the winning machine was driven by an oil motor. The chief objections to the oil or vapor type of automobile are the vibration and the odor. The vibration, due to the explosions in the cylinders, is a serious objection and it is engaging the earnest attention of all makers of this type. It ought to be possible to moderate, if not entirely control, the noise of the exhaust by some muffler, such as has been used to good effect on stationary engines.

The steam motor car will probably show its best results in the heavier classes of work, for which it is admirably adapted. As compared with the oil motor it is necessarily, on account of the large amount of cooling water that has to be carried, the boiler weights, etc., heavier in proportion to its power. Steam motor cycles are being used for pacing some of the fastest riders in the United States, but their performance would indicate that as at present constructed they are not thoroughly reliable.

There remains the automobile driven by compressed air, of which we have heard so much recently in New York. Compressed air undoubtedly possesses some very attractive features, such as its cleanliness, the absence of noise, odor, and dirt of any kind. Where it is used in connection with a large central power station, we know of no reason why it should not hold its own, in the matter of cost and convenience, with electricity, and in respect of large horse power as applied to individual trucks for use in heavy hauling we think it ought to more than hold its own with the steam motor.

At the present time France is easily maintaining the premier position which is hers by right as having first seriously started the automobile industry. Germany and England were later in the field, and we have been the last country to take up this new industry in earnest. Judging from the large amount of capital which is being interested, we may look for very rapid developments in the next two years in this country, and we think it will not be long before our American machines equal and surpass those of French manufacture in the important features of appearance, running qualities, and cost.

AN AMERICAN RAILWAY IN CHINA.

If existing arrangements are carried out, the proposed American railway line in China will prove an important link in a system connecting all of China with the outside world. Railway lines now actually built or under construction as well as those which are only projected form a great circle, sweeping across Europe and Siberia to the Pacific, thence southwardly to China, skirting the Pacific coast, thence eastwardly to Burma and India to the Indian Ocean and the Arabian Sea, and pushing thence through Persia, will complete the grand circle of all the continental mass of Europe and Asia. The Canton-Hankow line which the American syndicate has agreed to construct and for which it is expected that the Chinese government will confirm the concession stretches northward from Canton to Hankow, where a Belgian syndicate has a concession for the construction of a road northward to connect with the existing line now reaching Pekin, the capital of China. Should the Belgian syndicate omit to take advantage of its concession, the American syndicate has an option for the right to construct the Hankow-Pekin line also. From Pekin a road will connect with the Trans-Siberian Railway, which is now under construction to Port Arthur, thus making the American line an important link in the great system which will stretch from St. Petersburg by way of Siberia and Port Arthur through China to Canton on the coast, immediately opposite the Philippine Islands, which are only 600 miles away.

From Canton westward to Southern China, British interests have projected railway lines to the southwestern extremity of China, where they will connect with the present railway system of Burma, and in turn with that of India, which already has more than 20,000 miles of railway in operation. It is only a few hundred miles from the western terminus of the Indian railway lines to the point in Persia toward which Russian engineers are now pushing surveys for railway lines. This is a gap which can be easily filled whenever British interests deem it desirable to have direct railway intercourse between India and the railway systems of Southeastern Europe. From this it will be seen that the proposed railway line in China will form an important link in what promises to be, in the comparatively near future, a great railway system, bringing the Orient into direct railway communication with all Europe both by the northerly and the southerly route.

A COMMERCIAL NEED.

Three of our consuls stationed in South America have thus far this year called the attention of the State Department to the advantage Europe holds over the United States in the commerce of all that region. Perhaps not unnaturally each one suggests the stereotyped and threadbare idea or remedy of the establishment of direct lines of transport between the leading ports of the United States and of South America. It has so often been pointed out that such subsidized lines can only carry goods, but not sell them, and that goods so transported must be in every respect as salable as those with which they come in competition, that it is a rather serious commentary on the brief duration of the average consular incumbency, and consequent inexperience, that such reports should continue to appear with remarkable regularity.

Any observant commercial traveler in Latin America must be impressed with the presence of two prime factors that mainly account for our trade inferiority in those regions. The first of these is the greater intimacy with the life, social and political, of the people from whom they are seeking trade privileges that is maintained by European representatives in those regions. Your German manufacturer's agent, for example, will be found, quite seven times in ten, to have married into a native family and to have thoroughly cultivated those social side issues which are so effective in increasing influence. On the other hand, the American representative too often is "right from New York," making a flying trip from port to port, spending less time along the entire mighty stretch of the Atlantic seaboard, from Maracaibo to Buenos Ayres, than it should take him to become intimately acquainted with the trade needs and peculiarities of one of the many ports entered. Hence, it very naturally follows that in too many cases the American manufacturers never get a fair idea of the intense Latin conservatism of those markets, and of the fact that it is not "Yankee notions" that are wanted, but South American notions made with Yankee thoroughness and at prices made possible by our ingenuity.

The other factor in the problem is one of credits. Europe gives six, nine and even twelve months; America, the complaint is often made, seeks to collect the bill almost before the goods have been unpacked.

Both these prime difficulties in the way of our taking our natural position as first in the South American trade are to be overcome in one way. Let the manufacturer or the commission house intending to conquer a given trade territory appoint as representative a man resident in that territory, preferably one who is of the people or, at least, married into and socially identified with them. Such a man will be useful in proportion as he reverses the present American procedure; i. e., he will take flying trips to America to personally acquaint his employers with what he knows, rather than, as now, take them from America, to return to his chiefs to tell them what he guesses.

FIRING HIGH EXPLOSIVES.

The test which was recently carried out at Sandy Hook of the firing qualities of a new type of high-explosive shell which is designed to be used in service guns, using smokeless or other powder, is by far the most successful as yet attempted. The Isham shell, which is named after the inventor, is divided in its explosive chamber into many smaller compartments by transverse diaphragms. The designer's object is to so far reduce the shock of firing that the most sensitive of high explosives may safely be used as a bursting charge. The shell which was used in the test was of 12 inches caliber and was both longer and heavier than the 12-inch projectiles used in the new army 12-inch rifle, its exact weight being 1,036 pounds. The Isham shell was loaded with 113 pounds of explosive gelatine, one of the most powerful of known high explosives; a firing charge of 450 pounds of brown powder, which is the regular service charge of the gun, was used. The gun was fired with a slight elevation in order to bring the point of contact with the water well

© 1899 SCIENTIFIC AMERICAN, INC.

within the range of vision. On firing, the shell left the gun without exploding and struck the water at a distance of about two miles from the shore, where, after richocheting twice without any explosion, it sank. The result was extremely satisfactory, showing that one of the most powerful of modern high explosives may be used in a modern rifle of the ordinary service type.

The next test was carried out with a new explosive known as thorite, the invention of Dr. Tuttle, of Tacoma, Washington. An ordinary 8-inch service shell, charged with 13 pounds of thorite, was fired out to sea with a charge of brown powder, and failed to explode. In another test an armor-piercing shell, loaded with thorite, was fired at a 4½-inch steel armor plate, and passed through without bursting. The significance of these experiments can hardly be overestimated. All that is now needed to allow the explosives to exert their full theoretical destructive effect is a projectile which will be burst into fragments of a proper size for penetrating and wrecking the interior structure of a vessel. Hitherto, the disadvantage of high explosives when used in projectiles has been their tendency to burst the shell into fragments too small to do effective work within the vessel.

BRITISH PATENTS IN 1898.

The report of the Comptroller-General of Patents for the year 1898 has been issued. For the first time since the 1884 Act came into force there has been a falling off in the number of applications for patents. In 1898 they numbered 27,659, while in the preceding year there were 30,952 applications, showing a decrease of 3,293 or more than 10 per cent. The comptroller is of the opinion that the rapid growth in the number of applications which took place in 1896-97 was to be attributed to the activity in the cycle industry. Still, out of 6,000 applications made in 1897 in connection with cycles, only 2,300 were completed, much less than the average. In the total number of applications, naturally the major part came from England and Wales, 17,389 coming from the two countries. There were only 1,395 applications from Scotland and 502 from Ireland. The three foreign countries from which the largest number of applications came were the United States with 2,629, Germany with 2,599, and France with 1,133. This shows that American inventors fully appreciate the great advantages of a British patent. There were only eight other countries from which as many as a hundred applications came. There has been an increase among certain chemical classes, notably those which are connected with the acetylene industry.

Since the passing of the "Workmen's Compensation Act," the number of applications relating to guards for the prevention of accidents with machinery has been very largely increased. A single death or injury will often make considerable difference in the number of applications. For instance, after a railway accident caused by a luggage truck falling on to the line in front of an express train, there was a great increase in inventions for railway platform luggage trucks. As showing the relations between passing events and the course of invention, it might be mentioned that the publication in a London morning paper of a letter relating to the waste of horse-feed in London was followed within five weeks by no less than 34 applications for patents for nose-bags for horses, while the average number up to this time had been only 12 annually. This is an excellent example of the advantages which accrue to the inventor by the publicity which is given to legitimate wants. There is little doubt that many of our important inventions have been suggested by chance statements which have appeared in various papers as to the actual need for machines or processes.

LIQUID AIR IN MEDICINE AND SURGERY.

The subject of liquid air in its application in medicine and surgery has been treated in a dispassionate manner by Dr. A. Campbell White in The Medical Record. The general properties of liquid air have already been described in the columns of the SCIENTIFIC AMERICAN at considerable length, so that it is not necessary to dwell upon this phase of the subject.

In applying liquid to the tissues of the body, Dr. White has used it in the form of a spray and by means of a swab dipped into the fluid. If a spray of liquid air is applied to the skin, the part at once becomes anæmic and perfectly colorless. If the application is made only for a few seconds, the color as quickly returns and the skin is congested for some minutes thereafter. Within much less than a minute's time, by means of a spray, the part is frozen as hard as ice, but strange to say, in a few minutes circulation returns without any injury to the tissue, provided the part is not in the end of some extremity. There is no pain in the application excepting at the very beginning, but there is a slight burning or tingling. It also completely anæsthetizes the part to which it is applied without freezing it solid. Dr. White has tried liquid air as a local anæsthetic in a number of cases with invariable success. It has one important advantage; that is the absence of hemorrhages during the operation, enabling the operator to apply the dressing before any hemorrhage sets in, the dressing then being sufficient to stop any oozing. Dr. White has found the use of liquid air beneficial in the local treatment of ulcers, etc. He states that an abscess, boil or carbuncle in the early stages is aborted absolutely with one thorough treatment. If it is more advanced several applications at intervals of twenty-four hours are necessary. Liquid air has also been used with advantage in cases of sciatica, neuralgia, etc.

An interesting experiment was tried in a case of ivy poisoning, involving the entire left forearm and hand. A band around the forearm about three inches wide was slightly frozen by the spray, and then the usual treatment was applied to the entire poisoned area, including the part which had been treated with the liquid air. At the next dressing the part which had been treated with the air was very distinct, and this portion was greatly improved, the inflammatory process having subsided. A number of other diseases have also been treated with liquid air with marked success. Where no loss of tissue is desirable, liquid air should be applied by the spray and not by the swab. Dr. White takes issue with Mr. Hampson, whose article appeared in the SUPPLEMENT, No. 1226, entitled "Liquid Air." Dr. White is undoubtedly correct in advising the greatest possible care in using the new substance which science has placed at the disposal of the surgeon. Even such cooling agents as the ether-spray should be used with great caution, and liquid air should be applied only by those who have had some experience in its use.

In conclusion, Dr. White considers that we have reason to hope that we have in liquid air a therapeutic agent which will remove many otherwise obstinate superficial lesions of the body and cure some lesions which have hitherto resisted all treatment at our disposal, including the knife. He is of the opinion that in the use of liquid air in medicine, that is to say, in pulmonary diseases, in the reduction of fever, etc., a large field is open which presents many obstacles at the very start, and possibly holds out much hope in the future.

ACTIVITY OF AMERICAN CONSULS.

Only a few years ago it was a common experience to hear a good deal of fun poked at our consular service. This was due, no doubt, to the lax system of political appointments which formerly prevailed. A great change, however, has taken place in regard to our foreign service, and there is no doubt that recent administrations, especially the present one, have done much toward bettering the service and raising the standard of our representatives abroad. The political hack who is out of a job will no longer do, and the modern requirements of the office demand that our consular representatives should be men of character; the obtaining of information concerning trade and commercial conditions and the preparation of reports required by the government renders the office no longer a sinecure. That the work that is being accomplished by our consuls is beginning to be appreciated by our people is evinced by the interest that is taken in their Reports* by the public, and especially by the commercial classes. That this work is regarded with some misgivings by foreigners is shown by the rather suspicious attitude that was exhibited toward our consuls in some parts of Germany during the past year. A most interesting article appeared in a recent issue of London Engineering, and we take pleasure in publishing it entire, under the title there given it:

"The great industrial and commercial activity which at present prevails in the United States is due to many causes, some of which we have noted from time to time. No doubt the immediate cause was the war with Spain, which called into action so many of the forces which were lying latent, but the general economic and industrial conditions were favorable. A new spirit seemed to seize the Americans. The Monroe doctrine was forgotten, and they determined to become a world power. That spirit has entered their consuls stationed in the various countries of the world, and they have become active agents for pushing American industry and commerce. This is clearly shown by a document which was recently published by the State Department at Washington. To a superficial observer, it does not appear to be a publication of much importance, as it only professes to be an index to the consular reports; but when it is closely examined and taken in conjunction with the instructions to United States Consuls issued by the State Department in August, 1897, it throws some interesting light on the new activity of American Consuls, and on the efforts which the State Department is making through the consular service to enhance the position of the United States as a country exporting manufactured goods. As we some time ago explained, the State Department has now a very complete system for the publication of consular reports. From the beginning of 1898 they have been issued daily, instead of monthly as was formerly the case. The information is thus always fresh. The consuls were instructed to be prompt in furnishing their reports, and their notice was directed to a wide range of subjects on which information was required. They were, in short, constituted advertising and information collecting agents for the United States in all parts of the world. Their reports took the shape of a daily bulletin, which reviewed the condition of the world's trade, and gave information which was intended to help the United States to obtain as large a share of it as possible. This bulletin is sent to all the newspapers for publication, and to all the Chambers of Commerce for the use of their members, and otherwise is made as public as possible. In fact, it can be obtained free of all cost by any manufacturer or exporter who cares to take the trouble to get the Congressman from his electoral district to enter his name on the State Department list. The index which was recently published covers the first year of the new series, and is contained in a book of 78 pages, and includes in round numbers 4,600 entries. This, however, only means about 1,550 reports, for each report is thrice entered: under the name of the consul forwarding it, under the subject of the report, and under the country from which it comes.

A study of a few of the reports written by American Consuls shows that they have a most intense belief in their own country and in everything which comes from it. They are most optimistic in their views regarding the future of American trade in all parts of the world, and have little hesitation in expressing the opinion that American goods have only to be known in order that they may obtain a pre-eminent position in the district they represent. It must be admitted that they display wonderful alertness in pointing out any likely opening. No important contract is open without its being made known to American manufacturers; and if a strike takes place, those who are engaged in the industry concerned are immediately notified, and advantage is taken to push their goods, a fact which should be carefully kept in mind both by employers and workers when they are inclined to quarrel about wages or conditions. Many of the American Consuls are men who have had experience on newspapers, and they have often obtained their posts as rewards for party services. These men, as a rule, are trained observers and are able to present their case in the most favorable light; and it is quite evident that their newspaper experience has been of use to them, for both the matter and the arrangement of their reports are superior to the average of those published by the British Foreign Office. Although a great improvement has taken place in these latter in recent years, still many are evidently the work of men who have no practical experience in the department on which they are writing, or in making reports which are likely to be useful to manufacturers or merchants. The new duties which have been placed on American Consuls are rapidly revolutionizing the service. It is no longer the refuge of the partisan who has been able to influence an election; the public scrutiny which is now given to their work demands a high standard of efficiency, which is only possible by men who have the requisite knowledge and experience."

* See weekly issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

STEEL DREDGES FOR NEW YORK HARBOR.

The Maryland Steel Company has just closed a contract with the contractor who has undertaken to dredge out the east channel of New York Harbor for two great ocean-going dredges somewhat similar to the ones used on the Mersey in England. They will be built throughout of steel and will cost about $450,000 each. They will take up the mud, clay and gravel on the bottom of the bay by a suction pipe and this material will be deposited in its own hold instead of on a barge and when full will steam out to sea and dump it. The dredges will be 320 feet long, 48 feet beam and the depth of the hold will be 26 feet. The twin screws will be driven by two triple-expansion, four-cylinder engines. The hydraulic pumping and suction apparatus will be operated by independent tandem compound steam engines. The dredges can make 12 miles per hour when loaded and they move at the rate of 3 miles per hour while gathering up material. The hoppers will hold 3,500 tons. When once started they will stay out night and day, ample accommodations being provided for officers and the crew. The first dredge will be delivered about May 1, 1900, and the second a short time after.

A PRIZE FOR A LIFE-SAVING APPLIANCE.

It has recently been announced that a prize of $20,000 will be given for a life-saving device to be known as the "Pollok Life-Saving Appliance." The American Security and Trust Company, of Washington, D. C., is the custodian of the fund, which is offered by relatives of Mr. and Mrs. Anthony Pollok, who perished in the ill-fated steamer "La Bourgogne." Particulars of the nature of the appliance have not yet been made public, but our readers who are of an inventive turn of mind will be informed of all the requirements as soon as the conditions governing the competition are definitely formulated.

© 1899 SCIENTIFIC AMERICAN, INC.

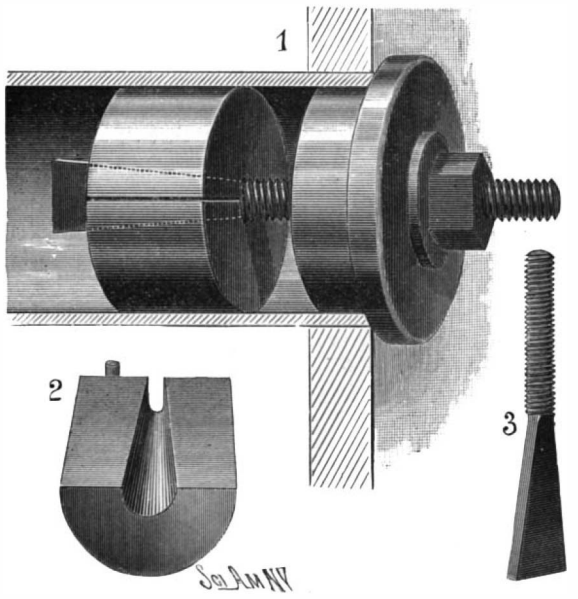
AN IMPROVED FLUE-STOPPER.

A flue-stopper especially adapted to close the ends of boiler-flues has recently been patented by John W. Fleming, 247 Ryerson Street, Brooklyn, New York city.

Fig. 1 is a perspective view of the stopper in operative position. Fig. 2 is a detail perspective view of a section of the stopper-body. Fig. 3 represents a key used in connection with the stopper.

The stopper-body is constructed in two sections, each of which, as shown in Fig. 2, is formed with a groove whose tapering side walls and inclined bottom wall deepen its contracted end. The channel formed by the registering grooves is adapted to receive a key (Fig. 3) having a wedge-shaped inner part and an outer, threaded, cylindrical part. Before the body-sections are brought together, the wedge-portion of the key and a part of the threaded cylindrical portion are placed in the groove of one of the sections, so that the wedge can expand the sections.

When the stopper-body has been properly placed within the tube, the threaded part of the key extends through a cap having a body which enters the flue and which is provided with a flange formed with a peripheral groove to receive the end of the flue. A lock-nut is carried by the threaded portion of the key and has a bearing on the cap. By turning the lock-nut, the stopper-body sections are expanded; and at the same time the cap is tightly forced against the inner edge of the flue.



FLEMING'S FLUE-STOPPER.

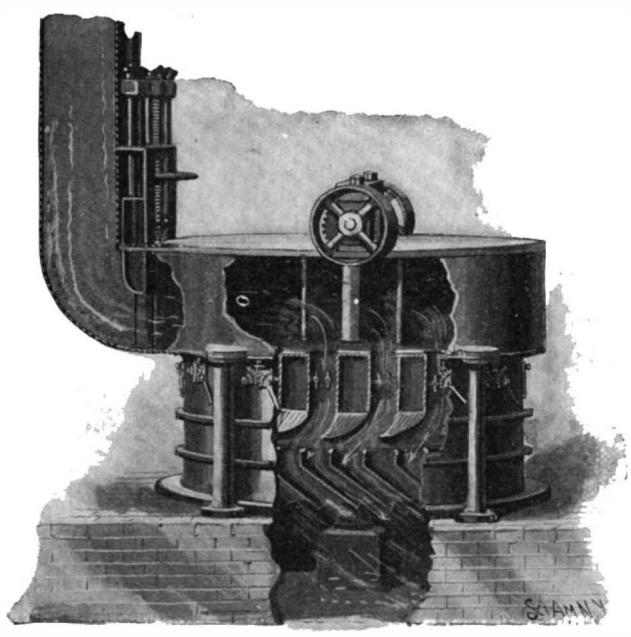
AN IMPROVED TURBINE WATER-WHEEL.

A patent was recently granted to John Sharpe, of Gravenhurst, Ontario, Canada, for an ingenious turbine water-wheel, by which it is claimed power can be obtained with a less amount of friction than with the ordinary construction of such machines.

The device is provided with a tank having a walled central opening. Connected with the tank are flumes controlled by gates, which, with their stems, are made hollow, so as to reduce their weight, to permit their being readily raised and lowered, to give access to the air and to allow this air to expand and contract with changes of temperature.

Below the tank a casing is located, in which the turbine-wheel rotates. The turbine-wheel buckets, it will be observed from our illustration, have their upper ends vertically disposed and their lower ends inclined downwardly. The water is directed to the wheel from feed-tubes by conductors curved at their lower edges, so that the water may impinge against the buckets at the proper angle. The feed-tubes are connected with the tank, and are each provided with two cut-offs operated from the exterior by means of gears, to one of which a handle is secured.

The wheel can be made in sizes, from one foot to ten feet in diameter, and can be constructed and transported in sections, which any ordinary mechanic can put together.



SHARPE'S TURBINE WATER-WHEEL.

WURDEMANN'S DIVIDING ENGINE.

BY CAPT. H. P. SANDERS.

Some years ago Mr. William Wurdemann, of Washington, D. C., devised a novel dividing engine now in the possession of Berger & Sons, of Boston, on which very accurate work has been done in graduating circles for astronomical instruments. As no account of this engine has ever been published, and but few persons are acquainted with its construction, a short description of it may be interesting to many readers of your valuable paper.

Engines of this kind as made by Troughton, of London, and others, consist principally of a circle or wheel supported upon a perpendicular axis and moved by a tangent screw gearing with teeth corresponding to the section of an internal screw cut in the edge of the circle. There are 2,160 of these teeth, so that one turn of the tangent screw moves the circle exactly ten minutes of arc. The circle to be graduated is secured upon the circle of the machine, and the cutting diamond or graver is moved in a radial line by means of a swinging frame attached to the framework of the machine.

The improvements invented by Mr. Wurdemann and embodied in his engine are many and of great importance, securing greater accuracy in results and requiring less attention from the operator, it being automatic in action and driven by a small motor.

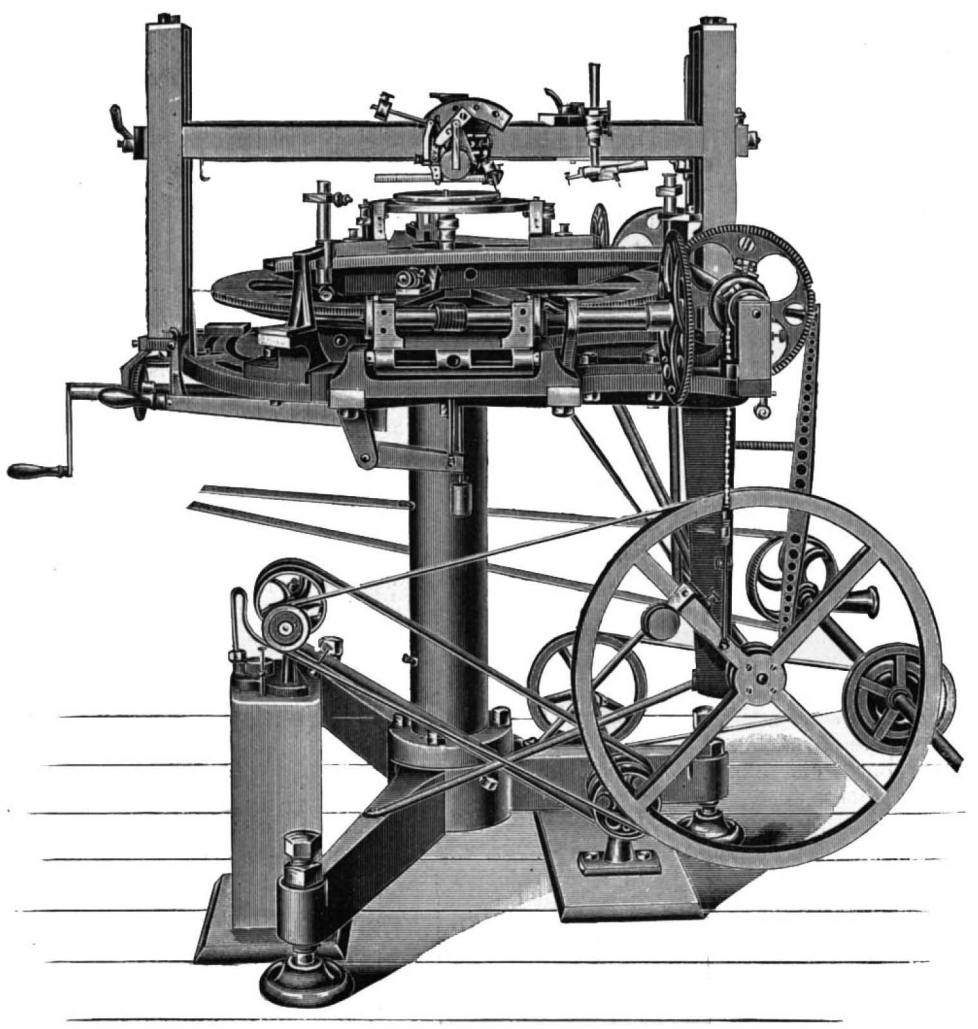
The improved machine is shown in the engraving; in it two driving screws are employed, geared together so as to move in the same direction and at the same speed, and arranged on opposite sides of the circle. Driving the circle by two screws tends to divide and equalize any errors or differences arising from slight imperfections in the gear teeth or screws, and any wear of the parts has a tendency to eliminate the errors. Furthermore, in consequence of the greater contact surface between the moving screws and the engaging teeth of the circle, there is less pressure and friction on these parts and the bearing is relieved of side pressure.

The moving screw has a drum-head graduated to 120, so that the automatic movement may be arranged to five seconds of arc. There is also a second drum-head with 200 graduations arranged for dividing the circle according to the centesimal system.

The axis of the circle is of novel shape, it being a perfect cylinder where attached to the circle and ending below in a hard steel cone that bears the weight. The effect of this long cylindrical axis is that the circle turns with uniform ease under all conditions of temperature. The axis enters a cast iron column, into which its upper end is perfectly fitted, so as to turn easily without any possible shake. The column is supported on a cast iron tripod with three leveling screws that step into iron cups. On the upper part of the column is fixed a cast iron frame, on which all the necessary moving parts are supported. The circle and its bearing are of hard cast iron; it will be seen that all the parts are made of a dense hard metal, having a small coefficient of expansion, consequently the working of the machine is not affected by slight changes in temperature.

The bars that carry the tracing works are placed on one side of the circle, so that these works stand out free and accessible in all their parts, while the tracing point is carried directly over the center line of the circle and is not interfered with in any adjustment that may be necessary during any one operation.

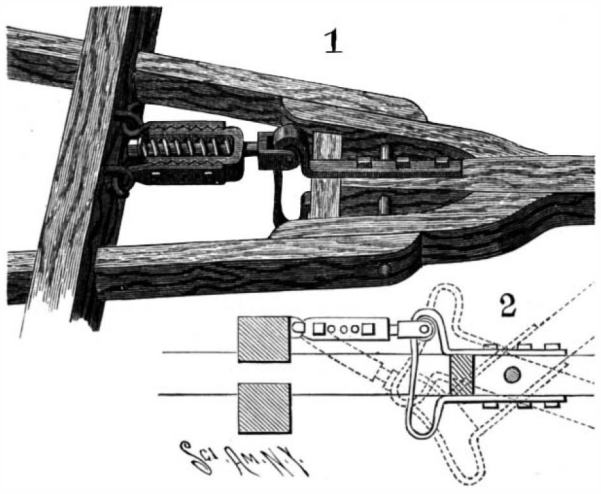
Although the circle of the engine is but 30 inches in diameter, a meridian instrument circle of 45 inches diameter has been graduated upon it to two-minute spaces, making 10,800 lines with a very satisfactory result, the probable error not reaching two seconds of arc, a degree of accuracy never before attained.



WURDEMANN'S DIVIDING ENGINE.

A NEW WAGON-TONGUE SUPPORT.

The subject of the engraving presented herewith is a wagon-tongue support, which is the invention of John C. Lambert, of Tonica, Ill., and which is arranged to support the tongue in any desired position so as to relieve the horses' necks from all weight and yet permit free up-and-down movement. Of our illustrations, Fig. 1 is a perspective view and Fig. 2 a sectional side elevation of the tongue support.



LAMBERT'S WAGON-TONGUE SUPPORT.

The support comprises a holder in the form of a curved band mounted on the fulcrum end of a pivoted tongue. The holder is engaged by a friction-roller journaled in the end of a spring-pressed sliding-rod which holds the tongue in position at any desired angle. The sliding-rod has a bearing in a pivoted guideway made in interlocking sections longitudinally adjustable on one another. As shown by dotted lines in Fig. 2, the tongue can be swung either downwardly or upwardly. In the former instance, the friction-roller travels on the inner face of the upwardly-swung holder, the tongue being held in adjusted position by the action of the spring-pressed sliding-rod carrying the friction-roller. In the latter instance, the friction-roller engages the upper end of the holder, the sliding-rod and guideway assuming a lowermost position. It is evident that the tongue, though free to swing at any time, is nevertheless held in any desired position to relieve the horses' necks from all weight. By lengthening or shortening the guideway, the tongue can be adjusted to large and small animals. When the wagon passes into an inclined position or a lower portion of a road, the tongue still retains its relative position.

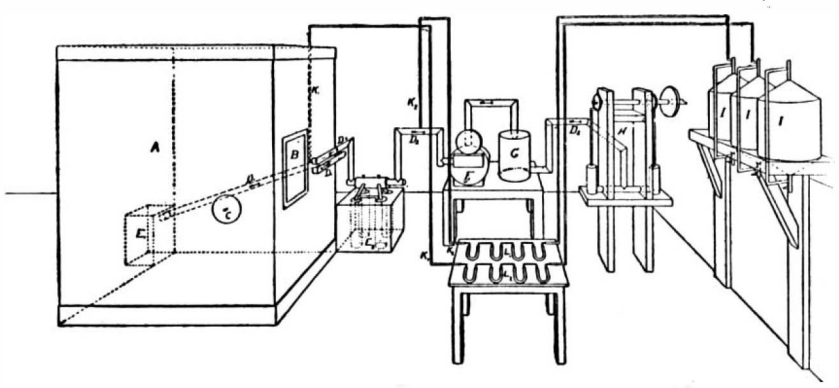
THE British Association will hold its sixty-ninth annual meeting at Dover, beginning September 13, under the presidency of Sir Michael Foster.

© 1899 SCIENTIFIC AMERICAN, INC.

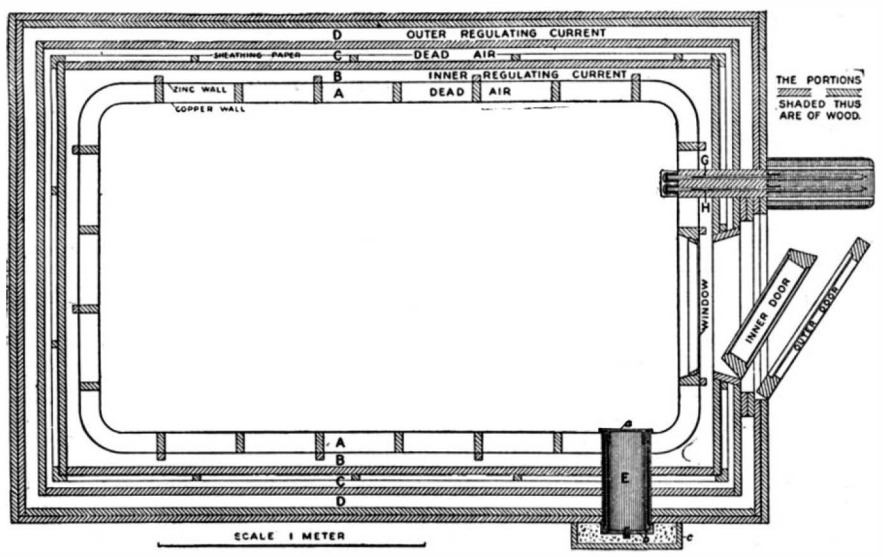
CONSERVATION OF ENERGY IN THE HUMAN BODY.

For several years Prof. W. O. Atwater, of Wesleyan University, and his assistants, have been carrying out some remarkable experiments relative to food and diet, viewed from a strictly scientific point of view. The results of their investigations have been published by the Department of Agriculture and by the Storrs Agricultural Experiment Station of Connecticut. Through the courtesy of Prof. Atwater and the office of the experiment stations of the United States Department of Agriculture, we are enabled to present an illustrated description of a respiration calorimeter which has been of the greatest assistance in making experiments on the conservation of energy in the human body. The purpose of the apparatus is to study, among other things, the conservation of matter and the conservation of energy in the animal organism. Viewed from the more practical standpoint, the object is to get more accurate information than we now have regarding the fundamental laws of animal nutrition, the uses of food in the body, the nutritive value of food materials, and the ways of fitting our food to the demands of health, work, and purse. The energy of the income is the potential energy of compounds of food and drink. The energy of the outgo is of two kinds, the potential energy of the incompletely oxidized materials excreted, especially by the intestines and kidneys, and the kinetic energy given off from the body in the forms of heat and external muscular work. This leaves out of account other forms of energy which may be given off from the body. The name by which the apparatus is called, "respiration calorimeter," is suggested by the fact that it is essentially a respiration apparatus with appliances for calorimetric measurements. The calorimeter is essentially a water calorimeter, that is to say, the heat evolved in the chamber is measured by a current of water.

The apparatus includes, first of all, a room or chamber in which the subject remains during the experiment. It is furnished with a folding chair and table for use during the day, and a folding bed for use at night. When the experiment involves muscular work, a stationary bicycle specially arranged for measuring the work is also introduced. Light enters through a window, so that the occupant can see to read and write. Ventilation is provided by a current of fresh air maintained by a pump, specially devised for the purpose. This pump not only keeps up a constant current of air, but also measures its volume and withdraws samples regularly and accurately for an analysis. The air is made to enter the chamber at the same temperature as when it goes out, so that the quantities of heat brought in and carried out by this ventilating current are the same. Arrangements are provided for introducing food and drink into the chamber and for removing the excreta, and for preventing the passage of heat through the walls of the apparatus. The heat given off from the body is carried away by a current of cold water which passes through a series of pipes inside the chamber, being the reverse process by which houses are heated by hot water. In this case the radiators become absorbers. By regulating the temperature of water current as it enters, and also its rate of flow, it is possible to carry away the heat just as fast as it is generated and thus maintain a constant temperature inside the chamber. The amount of the outgoing water and its temperature are measured, thus determining the heat carried away. Our large engraving is made from a photograph of the apparatus and does not show the pump and the aspirators used for moving, measuring, and sampling the ventilating air current, and the refrigerating machine is also not shown.



OUTLINE SKETCH OF RESPIRATION CALORIMETER.

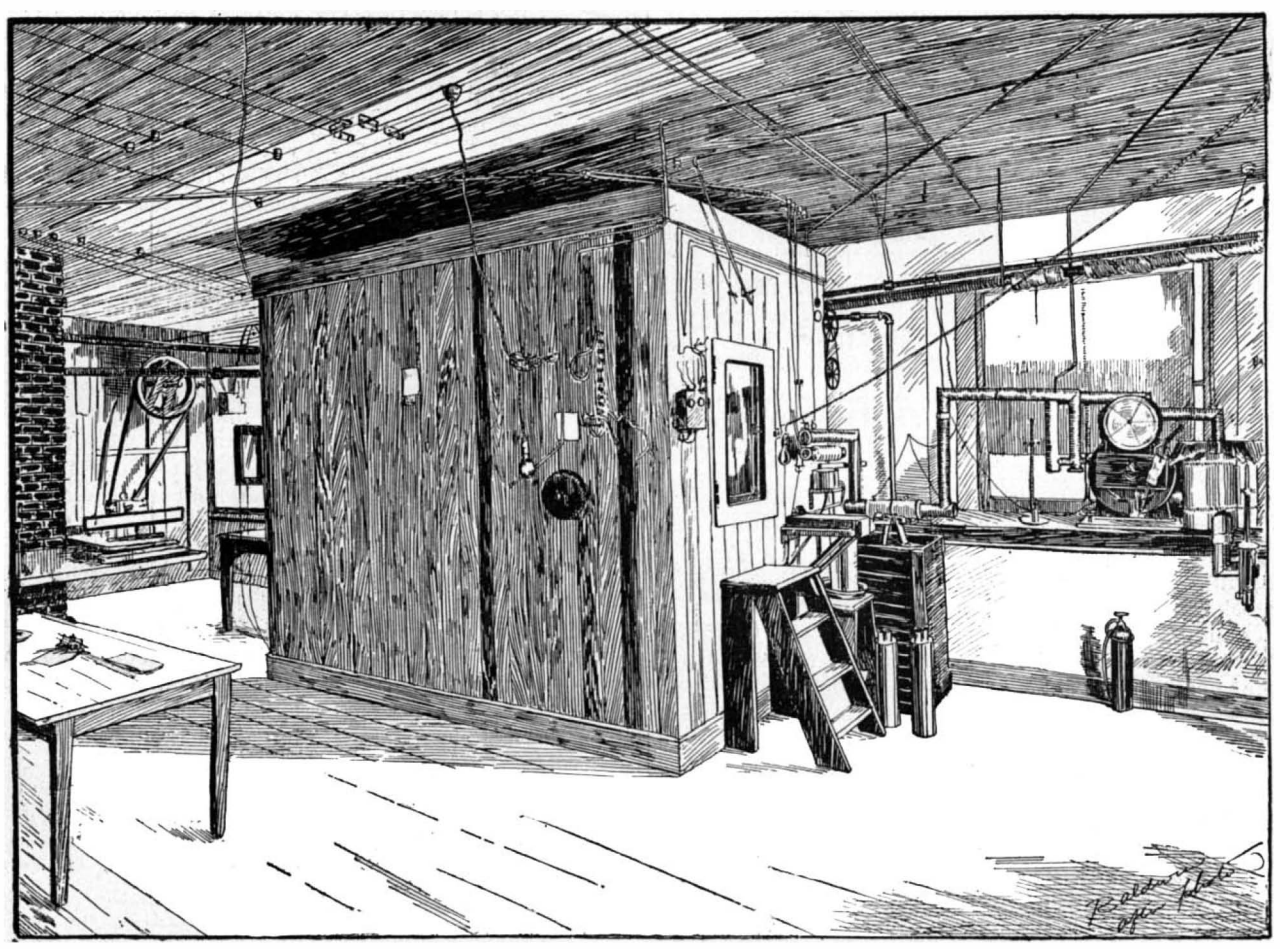


HORIZONTAL CROSS SECTION OF RESPIRATION CALORIMETER.

At the end of the chamber on the right is seen the glass door which serves as a window. To the right and just below it are the arrangements for cooling and for measuring the current of water which brings away the heat from the interior of the chamber. At the left in front of the brick pillar is a table at which the observer sits to record the temperature of the interior of the apparatus and of the currents of air and water. The refrigerating machine, which is behind the pillar, cools a solution of calcium chloride contained in a tank not shown in the engraving. The ventilating current of the air before it enters the chamber is passed through copper cylinders which are immersed in brine in this tank. The air is cooled to a temperature of from —2° to —8° F. At this low temperature nearly all of the water is removed from the air, so it enters the chamber quite dry. Just before entering the chamber at the right of the glass door it is warmed to the temperature of the interior of the chamber. The outgoing air is drawn from the upper left hand corner of the rear end of the chamber and then downward and out by the tube shown prominently in our diagram. In coming out of the chamber, the air passes through another freezing apparatus shown as a square block in our outline sketch. Thus it passes through the meter, *F*, by which its volume is measured, and onward to the air pump, *H*. A tension equalizer, *G*, is placed between the pump and the meter. The respirators for sampling the air are shown at the extreme right.

The plan of the respiration chamber will be readily understood by reference to the cross section. The interior is 7 feet long, 6 feet 4 inches high and 4 feet wide, the corners being rounded. The cubic content is 175 cubic feet. The inner wall is made of large sheets of copper, the seams being soldered so that when the windows and other openings are closed, the chamber is air tight, so that all the air which comes in and goes out can be measured. There is a zinc wall 3 inches outside the copper wall. This metal chamber is the calorimeter proper and is supported by a wooden framework in the open space. In order to protect it from the fluctuations of the temperature of the room in which it stands, it is inclosed within three concentric walls of wood. Between the zinc and the innermost wooden wall is an air space of 2 inches wide. Between this wall and the next is a third air space of 2 inches, and finally a fourth air space of equal size. The wooden walls are made of matched pine covered with sheathing paper. The outer wall is double, with sheathing paper between. The air in the spaces, A and C, is dead air, while in the spaces, B and D, the air can be kept in constant circulation by means of rotary fans in boxes outside. It is thus possible to regulate the temperature with wonderful accuracy, the outer air current, D, being used for the coarser regulation of the temperature and the space, B, for finer regulations. The walls are provided at the right with a glass window and a door. At E is a copper cylinder which goes through all of the walls and the chambers. It is 6 inches in diameter, and serves for passing food and other materials in and out of the calorimeter chamber. Communication with the subject in the chamber is rendered easy by means of a telephone.

Measurements of the temperatures are made in part by mercury thermometers, but mainly by electrical methods. There are five electrical thermometers in different parts of the chambers, and the measurements are so delicate that even the movements of the person inside, such as rising from the chair, reveal themselves to the observer outside by the immediate rise in the thermometric reading. The difference between the temperature of the copper wall and that of the zinc is measured by a system of thermo-electric junctions in three and four pairs distributed over the sides, top and bottom. The difference of temperature of the two walls is made as small as possible by warming or cooling the air in the space, B. On the observer's table is a galvanometer and scale Wheatstone bridges, and banks of electric lamps, for varying the heating currents and switches to bring the various circuits into play. In front of the table is the record book for noting the observations, which are very numerous. With the aid of the devices which we have so briefly described, the experienced operator at the observer's table can easily control the temperature of the space, B, and make it follow the variations of the interior of the chamber very closely. The current of cold water which passes through the heat absorbers inside the chamber is but generally little above the freezing point, and it is arranged to flow at such a rate as to absorb and carry off the heat as fast as it is generated inside the apparatus. The temperature of the water is measured as it enters and as it comes out. The volume of



ATWATER AND ROSA'S RESPIRATION CALORIMETER.

© 1899 SCIENTIFIC AMERICAN, INC.

water is measured automatically by a proper apparatus. We have already referrd to the meter pump, which regulates, measures, and samples the ventilating air currents. We have also referred to the cooling apparatus.

For each experiment, which usually occupies several days, a diet is selected such as has been found by previous experiments to meet, as nearly as may be, the needs of the person under experiment. Most of the materials, and specially the meats, are prepared in advance, and are kept in cans after sterilizing, if necessary. In putting up bread for use, the crust is removed and the crumb is cut in small pieces and likewise canned. The butter is carefully weighed and put in small cups, and everything else is done in the same way. Samples of everything are taken for analysis. The determinations made are in general for water, carbon, hydrogen, nitrogen, ether extract, ash, and heat of combustion. A careful measurement and analysis is made of the excretory products. In the first or preliminary period of four days these analyses are made, the data sufficing for a digestion and nitrogen metabolism experiment, and on the evening of the fourth day the subject enters the respiration chamber, although the actual respiration calorimeter experiment does not begin until seven o'clock on the morning of the fifth day. A night's sojourn in the apparatus suffices to get the temperature of the air in the apparatus and its content of carbonic acid and water in equilibrium, so that accurate measurements may begin with the morning of the fifth day and continue until seven o'clock on the morning of the ninth day, thus making the duration of this experiment exactly four days. The man weighs himself on a small Fairbanks platform scale specially made for the purpose.

The report of the Storrs Agricultural Experiment Station, and also the reports of the Department of Agriculture, are filled with most interesting tables giving the results of the various experiments, which we cannot reproduce here. In our SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 1210 and 1212, further information on food experiments will be found.

The following is a summary of the results of certain experiments. The purpose of the preliminary period of four days was to bring the body into at least approximate nitrogen and carbon equilibrium with the food and to make the determination of the amounts of nutrients absorbed as nearly accurate as practicable. The income and outgo of the nitrogen were determined during this period, which thus amounted to a digestion and metabolism experiment. The metabolism of nitrogen, carbon, hydrogen and energy was determined during the final period of four days. In one of the two experiments the man had as little muscular exercise as he could well have with comfort. In the other he was engaged in quite active muscular exercise. The external muscular work was expended in driving a dynamo which produced an electric current. The latter was passed through a resistance coil, and the energy was transformed into heat which was measured with that given off from the body. The difference between the income and outgo of energy as measured in these two cases was 3·2 and 1·1 per cent, and averaged 2·2 per cent. The amount of energy as measured was in each case less than the theoretical amount of potential energy in the material consumed. On the whole, the theoretical amounts of energy transformed and those found in the experiments is as close as could be expected under the circumstances. The experiments do not demonstrate completely the conservation of energy in the normal organism. They do, however, approach very closely to such demonstration.

The study of human nutrition is very important, and it is expected that in time, with the aid of the experience thus far gained, apparatus may be planned for experimenting with small animals, as sheep and dogs. If in turn this effort should prove successful, the next step will be to devise apparatus and methods for experiments with larger animals, such as horses, oxen, and cows. It may be asked what is the advantage of such minute and painstaking experiments, which are, necessarily, carried out at great expense. There are really few problems of more importance than that of nutrition, either as relating to man or animals. A better knowledge of these laws with reference to animals is needed as a foundation for proper understanding of practical problems which the farmer has to meet in the feeding of his stock.

The work of Prof. Atwater and his able assistants is being watched with interest by those who appreciate the serious and important nature of economic problems.

ACCORDING to a recent Consular Report, there are eighteen locomotive factories in Germany; fifteen of them build full-sized locomotives, and three build engines for light railways, steel works, etc. The total output of the factories is 1,400 per year. The combined working force is more than 15,000 men. German locomotives are exported to nearly every country in Europe, and also to some extent to Asia, Africa and South America. Up to the present time no locomotive from the United States has entered Germany.

Correspondence.

Use of Scientific Terms.

To the Editor of the SCIENTIFIC AMERICAN:

Is it not a matter of some surprise that modern scientific writers still cling to the use of obsolete names? Take for instance the term "Carbonic acid," or as it is sometimes written, "Carbonic acid gas," for the compound now more properly designated as carbon-dioxide, whose symbol is CO_2. Chemists have entirely discarded the use of the former names as being inaccurate, and now apply only the latter. There is, of course, another compound formed by the union of carbon-dioxide and water, which is the true carbonic acid. Its symbol is H_2CO_3. While difficult or perhaps impossible to isolate on account of its extreme instability, it is as positively known to be an acid as nitric acid or sulphuric acid, since from it are formed the primary and secondary carbonates of the metals represented by $MHCO_3$ and M_2CO_3.

Authors of late texts in chemistry all recognize this important distinction; but such writers as Gage, Hopkins, Carhart, Chute and others, in their works on physics, and Tarr, in his otherwise admirable text on elementary geology, do not seem to have paid much attention to it. Some, or it may be all, of them recognize the modern name carbon-dioxide, but they still cling tenaciously to the use of the old.

Would it not be better for all scientific men "to mind the same thing" and be strictly accurate? Science is nothing if not truth. W. B. BONNELL.

Wesleyan College, Macon, Ga., July 11, 1899.

Protection Against Electric Storms.

To the Editor of the SCIENTIFIC AMERICAN:

At the present time there seems to be much said about tornadoes, or electrical storms, and their great destructiveness, and as I have given considerable thought to this subject for many years past, I believe that much can be done to lessen their disastrous effects.

As long ago as 1855 I began the study of atmospheric phenomena, and studied in various ways the atmospheric currents, electric and otherwise, for a number of years, with the view of establishing a weather bureau.

In the year above referred to, I was in Minnesota and observed one of these electrical storms in operation; it was on the west of the Mississippi River, and had evidently come from a long distance. It passed through a primitive forest of immense growth just before reaching the river, and every tree, for nearly 1,000 feet wide and as far as I could see, was leveled to the ground as completely and evenly as though felled by the woodman's ax. I also noticed that this storm did not cross the Mississippi, but when it reached the stream it disappeared, the timber on the other side of the river not being disturbed at all.

In my studies since that time I have been more and more convinced that whenever these electrical storms reach large bodies of water they become dissipated—the electric current being taken up in the water. I have known small streams to be entirely dried up, and the water taken from them, when the water was not in sufficient amount to take up the current.

Observation from that day to this has led me to conclude that partial, if not full, protection to cities and towns can be obtained by the erection on the west and southwest of large copper or other metal conductors, strung upon steel or iron poles, and at intervals sunk deep into the earth—where water can be reached—these heavy electric conductors preferably of copper. When an electrical storm strikes these conductors, it will be taken up, as is often the case in telegraph lines, where I have known dozens of poles to be torn to pieces by one flash of lightning, while if made of steel and occasionally connected deep into the earth with water, the current would have been carried away and the damage averted.

Another and perhaps more effective method of carrying off these great bodies of electric currents contained in what is known as "whirlwinds," which form the worst kind of cyclones, would be to bond the rails of railways with copper—the same as electric railways for return currents—and occasionally sinking hundreds of feet into the earth (if need be to reach water) large copper or other metal conductors. This could easily be done without injury to a railway, perhaps at the expense of the county or State. The railways running in a line nearly north and south would be the most likely to absorb these currents, as nearly all tornadoes come from either the west or southwest, and where crossing these lines would be absorbed and conducted silently and harmlessly into the earth. Scarcely any railway extends very long distances without crossing either bodies of water or points where water can be reached; and if the conductors from well-bonded rails reach water, even many miles from the point where an electric storm strikes, it would be absorbed and carried to that point; but the more frequently water could be reached, the more effective would be this method of carrying away surplus electricity causing these storms.

It will be noted that this is only on the principle of the lightning rod—too many of which are defectively installed.

In this connection it will be understood that it is just as important to sink large conductors deep into the earth along the line of railways or other metal used as an electric conductor, in order to reach moisture, otherwise such bonding would not convert the railway into a safety guard any more than the ordinary electric road of to-day, which seldom has and does not so much need deep ground connections.

Pasadena, Cal., July 7, 1899. T. S. C. LOWE.

THE PEARL-BUTTON INDUSTRY OF THE MISSISSIPPI RIVER.

BY HUGH M. SMITH.

The business of making buttons from the shells of our native fresh water mussels is of quite recent origin, but has already reached comparatively large proportions and seems destined to have further growth. The fear is entertained, however, that, through indiscriminate fishing methods, the supply of mussels may be so seriously reduced that the continuance of the industry may be imperiled. The possibility of the early exhaustion of the mussel beds in that part of the Mississippi River which is in Iowa and Illinois led a number of interested persons to request the United States Fish Commission to make an investigation of the subject, as that is the section in which the business is more extensive and has been longest established. A comprehensive report* on the industry which has been prepared by the writer is about to be published by the Commission.

The manufacture of buttons from the shells of native fresh water mussels began in the United States in 1891, the inauguration of the business being made possible by the high duty on imported buttons imposed by the tariff bill of 1890. The first person to engage in this business was Mr. J. F. Boepple, who had for many years been similarly engaged in Hamburg, Germany. On account of an abundance of suitable mussels in its vicinity, Muscatine, Ia., was selected as the site of the first factory and has now become the leading center. Other towns on the Mississippi and its tributaries from time to time established works, until in 1898 there were twenty-one communities in Iowa and Illinois in which buttons were made. A remarkable development of the business occurred in 1898, no less than thirty-six factories being established during the first six months of that year. Button making has now become one of the principal businesses along a section of the Mississippi nearly 200 miles in length between Fort Madison, Ia., and Sabula, Ia. It gives employment to large numbers of people at what are considered good wages for such labor. It also supports a very important fishery, at which many hundred persons make a living. Another important feature of the Mississippi River button industry is the transformation of a hitherto useless product into a valuable commodity, which is placed on the markets at reasonable prices.

There are about 400 species of mussels found in the Mississippi River and its tributaries, but comparatively few are now utilized in or are adapted to button making. The requirements of a shell, from the button maker's standpoint, are sufficient thickness, a uniform color of the surface and various strata of the shell, and a degree of toughness that will withstand the necessary treatment without cracking or splitting. Thin-shelled mussels are absolutely useless for button making. Even if originally as thick as a button, the necessary grinding and polishing reduce them to mere wafers. The preferred color is white, but cream-colored shells are also employed. Shells with pink, purple, yellow, or salmon-colored nacre are not suitable, as the color fades with age and is apt to be not uniform. Certain shells that satisfactorily combine thickness and color are nevertheless useless, because they are soft or brittle and break easily during manufacture.

Coincident with the establishment of the button industry in Iowa and Illinois, there has arisen a new popular nomenclature for the mussels or "clams" utilized. The names applied by the fishermen and manufacturers have some reference to the color or shape of the shells. Originally quite local, they are now generally applied throughout the whole stretch of the river in which fishing is done.

By far the most important species of mussel used in button making is the "niggerhead." It has the general shape of the quahog or round clam, and is characterized by a very thick and heavy shell, with a black or dark brown outside skin and a glistening white interior, the latter color being uniform through the thickness of the shell. It is of relatively small size, the maximum being only 4½ or 5 inches for the greatest outside diameter, and the average about 3 inches. It is often found in immense beds, preferring muddy sand and muddy gravel bottom, but also frequenting sandy bottom. About a dozen other species are utilized. The principal, in the vernacular of the region, are the "sand shell," the "mucket," the "deerhorn," the "butterfly," the "bluepoint," and the "pocketbook."

* The Mussel Fishery and Pearl-button Industry of the Mississippi River. Bulletin of the United States Fish Commission. 1898. 26 pages, 24 plates.

© 1899 SCIENTIFIC AMERICAN, INC.

Owing to the comparatively shoal water in which mussels are found, they may be gathered with less difficulty than is ordinarily encountered in taking shellfish. Furthermore, the shoalness of the Mississippi makes every part of it accessible to the fishermen and renders the exhaustion of the beds more certain, speedy and complete.

Mussels are obtained with various kinds of apparatus. Those which have been or are now in use are the hand rake, the tongs, the rake hauled by means of a windlass, the dredge operated by steam, and the bar with hooks. The last named, a very ingenious contrivance, came into use in 1897 and has largely superseded other appliances. It consists of a circular iron bar, 6 to 8 feet long, with from thirty to fifty four pronged wire hooks attached at regular intervals in strings of two or three hooks. This apparatus, which is used from a small boat and is hauled over the bottom by means of a rope, depends for its action on the habits of the mussels. They rest on the bottom, or partly buried in the mud or sand, with the free margin of their shells turned up stream and with their shells separated to admit the water, laden with oxygen and food. When touched they quickly close their shells, and if a foreign body is interposed between the valves, it is tightly grasped and retained. Anyone who has not witnessed the use of this apparatus can scarcely realize how remarkably effective it is. Often when the mussels are abundant, almost every prong will have a mussel on it, and two or three are sometimes caught on one prong. When the beds of mussels are compact, one man can take 800 to 1,000 pounds of "niggerheads" in a day, and a case is reported where 2,200 pounds were obtained by one man in ten hours. The average daily catch at present, however, is probably not over 500 pounds.

After sufficient ice forms on the river, there is considerable mussel fishing through the ice with "shoulder rakes" and "scissor rakes." For the use of these appliances, under such circumstances, a hole two to six feet square is cut through the ice.

Throughout the river section mentioned, mussels are found in varying abundance. The natural tendency of some of the species is to form more or less dense beds, while others seem to be generally distributed. Considered as a whole, this part of the Mississippi River is undoubtedly one of the most favored sections of the United States, as regards abundance and variety of mussels adapted for buttons. The mussel beds are sometimes of great length, although usually quite narrow. One of the most productive beds was discovered near New Boston, Ill., a few years ago. It was about 1½ miles long and 60 rods wide, with the shells very thickly disposed. It is reported that fully 10,000 tons of shells, chiefly "niggerheads" and "muckets," with a few "sand shells," were taken therefrom during the past three years. The number of mussels represented by this enormous quantity was probably not less than 100,000,000. On some grounds, practically all of the mussels are of one species, while on others several species may be mixed in varying quantities. The largest and most compact beds are formed of "niggerheads" and "muckets."

It is estimated that in 1898 about 1,000 persons were engaged in taking mussels to sell to the button manufacturers along the Mississippi River, between Fort Madison, Ia., and Sabula, Ia.

The factories at which buttons are made are, as a rule, specially constructed two-story brick buildings, of considerable size, having a cost value of $5,000 to $30,000, which sum includes land, buildings, machinery, and general equipment. A few of them occupy parts of mills or machine shops. Some of the plants, at which only blanks are sawed, are also in special brick or wooden buildings, but most of the "saw works" are in connection with machine shops or in improvised outbuildings of private residences, some of the smaller ones being in simple sheds. A single room is sufficient for the mere sawing of the rough blanks, but the various steps in the manufacture of the complete buttons necessitate a number of rooms and make the factory a rather elaborate establishment, with the heavier machinery and rougher work on the first floor, and the different finishing processes on the upper floor. The daily capacity of the largest factories is 700 to 1,000 gross of finished buttons.

The essential work at all the factories is done by machinery. At all the larger and many of the smaller establishments, steam or electricity is employed; some obtain their electric power from the city electric plant, some have independent dynamos, some have steam engines, and some use the power of adjoining machine shops or mills. A gasoline engine, of two or three horse power, furnishes the motive power for the saws at several of the small works, and foot power is also employed in a few places.

Preparatory to being used, the mussel shells, as purchased from the fishermen, are sorted into sizes. Another preliminary step is the soaking of the sorted shells in barrels of fresh water for three to six days to render them less brittle. Even when only a few hours out of the river the shells become dry and brittle, and crumble or split under the saw.

The next step is the cutting or sawing of the rough blanks. The shells are usually held with special pliers while being cut; these grasp the circumference of the shell and enable cutters to retain it fast while holding the shell at right angles to saw. Some sawyers have the hand gloved or mittened, and use no pliers or pincers. At the more extensive plants a fine jet of water plays on the shell, as the saw revolves, in order to prevent the formation of dust and to keep the shell cool. The dust is very irritating to the respiratory passages and eyes of the cutters, and at some of the factories the dust is drawn into a tube by a current of air. The cutters in the smaller works often cover the mouth and nose with a cloth.

The saws are of flat steel strips about two inches wide, and of various lengths corresponding to the sizes of the buttons. These strips, after being provided with fine teeth along one of the sides, are accurately bent into a cylindrical form and fitted into heavy iron holders; the latter are adjusted to a lathe in which they revolve on a horizontal axis. As the blanks are cut they pass back into the saw and holder and drop into a box beneath the saw.

The next step is the dressing or grinding of the back of the blank, to remove the skin and make an even surface. To accomplish this, each blank has to be held with the finger against a revolving emery wheel.

Turning or facing is the next step. This, which is similar to the preceding, gives to the front of the button its form, including the central depression. This is followed by the drilling of two or four holes for the thread.

The button is now complete, with the exception of the polishing process. This brings out the natural luster which has been lost in grinding and which gives to these buttons their chief value. The buttons are placed in mass in large wooden kegs, known as tumblers, in which they are subjected to the action of a chemical fluid at the same time that the tumblers are revolving on a horizontal shaft. By mutual contact, combined with the effect of the fluid, the buttons become highly lustrous, while the fluid is churned into a milky froth. After being washed and dried, the buttons go to rooms where they are sorted into sizes and grades of quality, and then sewed on cards and packed in pasteboard boxes.

In all branches of the button industry a gross is considered as consisting of 14 dozen, in order to make allowance for the imperfect or defective buttons that are liable to be produced at every stage of the business from the cutting of the rough blanks to the sewing of the finished buttons on cards. The unit of measure of the size of buttons is the line, which is one-fortieth of an inch. The buttons manufactured on the Mississippi are from 12 to 45 lines in diameter. The largest buttons (40 to 45 lines) are made from "niggerheads." Following are the quantities of various-sized blanks that may be cut from 100 pounds of average-sized "niggerheads": 16-line, 28 to 34 gross; 18-line, 30 to 32 gross; 20-line, 24 to 29 gross; 22-line, 15 to 20 gross; 24-line, 12 to 15 gross.

A large number of persons are employed at the button factories at wages generally regarded as good. Besides men, who have the more arduous and important duties, many boys and girls are given employment. At factories in which finished buttons are made, from 30 to upward of 200 people are employed, the males and females being in about equal numbers. The factories which simply produce the "rough blanks" employ only males, the number of whom averages only 14. The total number of factory employes in 1898 was about 1,450, to whom the amount paid in wages was approximately $260,000.

It was apparent in 1898 that the button industry was being overdone by the establishment of numerous small factories at which rough blanks were sawed. Many persons engaged in the business without proper equipment or experience, and the very short life of some of the factories shows that the remarkable increase in the business in 1898 was not a healthy growth. Some of the output was not of standard quality, and a general lowering of prices was a result.

The prices received for rough blanks range from 10 to 20 cents a gross, depending on size and quality. The prices correspond rather closely with the sizes, an 18-line blank, for instance, bringing 18 cents a gross; but as a rule the prices are less than the figures representing the sizes of the blanks, being 1 to 3 cents "under the line." The average size of the rough blanks is 18 or 20 lines, and the average value per gross is 16 or 18 cents. The wholesale prices received for the finished buttons have been a little over double those of the rough blanks of the same sizes, or about 40 cents a gross.

The quantity of mussels utilized in button-making in 1898 was about 7,000 tons, having a cost value of $72,000. The manufactured output consisted of about 2,250,000 gross of buttons and rough blanks, with a market value of more than $500,000.

Although the mussel fishery is under ten years old, and in most places began within the past two or three years, it has already had a pronounced influence on the productivity of the mussel beds and bids fair to lead to serious consequences to the capital invested in the button industry. Throughout this stretch of river, wherever fishing has been at all regular or active, there has been a more or less marked reduction in the abundance of mussels of all kinds utilized in making buttons and in some localities the depletion of the grounds has been almost complete. The many persons financially interested are very desirous that appropriate measures be taken to insure the existence of a substantial business of this kind. Suspension of the industry—which is not a remote contingency—would prove a calamity to many communities.

The history of the fishery up to this time shows the disregard for the future which has come to be regarded as characteristic of fishermen. The decrease in the mussel supply has been brought about by several practices, chief of which is the activity of fishing operations. Not only have large quantities of mussels been taken from the beds at one time, but the fishing has been so incessant that no opportunity has been afforded the beds to recuperate. The shoalness of the water has made it possible to thoroughly scour almost every foot of ground. The failure of the fishermen to suspend their operations immediately prior to and during the spawning season of the principal species of mussels has undoubtedly had a serious effect on the supply.

Not the least injurious feature of the fishery is the gathering of small mussels for market and the incidental destruction of small shells that are not utilized, but left on the banks or the ice to die.

The testimony of the button manufacturers, and the evidence afforded by their shell heaps, indicate that there are comparatively large quantities of immature mussels taken. This practice depends to some extent on the depletion of the grounds of the larger mussels, necessitating the gathering of the smaller ones to make a fair catch, but also on the indifference of the fishermen to the great injury thus done the mussel supply. The manufacturers are, of course, equally indiscreet in continuing to purchase lots of small shells, and a few of them refuse to do so, but it is generally not feasible to exclude the small shells mixed with the larger ones.

The effects of natural enemies and physical agencies on the mussel supply become more important when combined with the fishing operations. Animals which are known to prey on the mussels are muskrats, minks, raccoons, and hogs, the first and last being especially destructive. The freshets to which the Mississippi is periodically subject undoubtedly do great damage to the mussel beds, burying them under sand and mud. Shifting sand-bars are also known to cover up beds. The fishermen sometimes find extensive beds of dead shells which appear to have been recently uncovered by the current. During freshets, when the stream finds new channels, many mussels are carried from their beds and left dry when the water subsides. Droughts also are liable to expose mussel beds and cause much destruction. However, pollution of the water by refuse from cities and manufacturing establishments is perhaps the most serious menace to the mussel beds, next to the operations of the fishermen. Certain kinds of refuse are very injurious and are capable of killing practically every mussel with which they come in contact.

If, therefore, the button industry of the Mississippi is to be maintained, it seems essential that the States interested should promptly take joint action to prevent the gathering of small mussels, to give some protection to the principal mussels immediately prior to and during the spawning season, and to prohibit the running of factory and other refuse on the mussel beds.

Melting Babbitt Metal.

In many shops it is customary to melt babbitt metal in the smith's forge—a very wasteful and vicious method, when it is considered that the forge gives too intense a heat for properly melting babbitt, and that babbitt metal injures the working of the forge whenever any of the metal finds its way into and remains in the tuyere. Lead there will effectually prevent the welding of iron as long as it is exposed to the action of the vapor of the lead. A much better way, and a cheaper one, is to rig up a little gas bench for the melting of small lots of babbitt. When a quantity of it is to be handled, a furnace similar to that used for melting out—and melting in, too—the lining of axle and motor boxes will do. But the gas bench is made of one or two heavy gas burners similar to those used in kitchens for cooking. They are placed in an iron bench, and proper iron bearers rigged for holding the ladles in place. With this rig the heat can be regulated at will, and there is no danger of melting out the bottom of the ladle before the workman is aware it is even red hot and before the babbitt is fairly warmed through. —James Francis in Street Railway Journal.

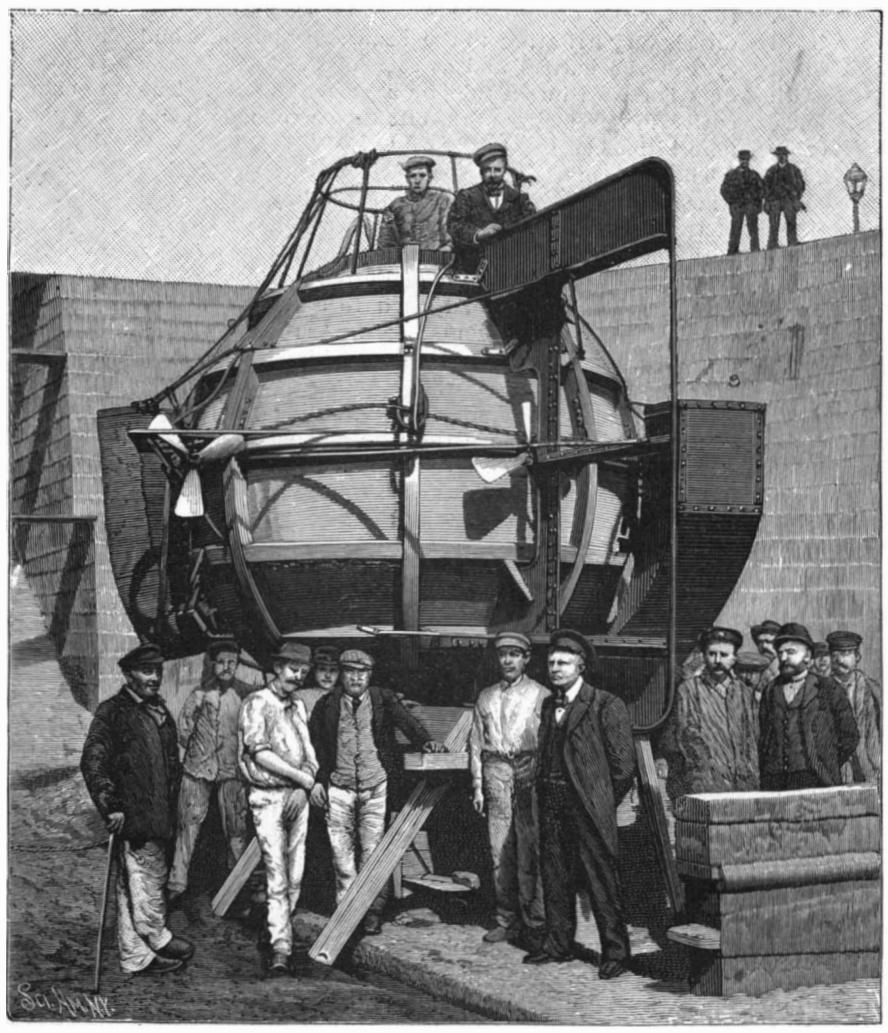
AT the State camp, Peekskill, N. Y., it is stated that light portable furnaces in which almost any substance can be cremated in a few seconds will be tried, instead of latrines. No sinks will be dug. It is thought that if the experiment is successful, it will revolutionize military camps and obviate the outbreaks of typhoid fever which are so prevalent in military camps.

© 1899 SCIENTIFIC AMERICAN, INC.

THE SUBMARINE VESSEL "LA FRANCE."

Trials have just been made at Cherbourg of a new submarine workshop christened "La France" and constructed after plans by M. Piatti. This apparatus, after being put in order and ballasted, was floated out of the dry dock in which our engraving represents it, and was towed outside of the roadstead by the "Ville de Cherbourg," which had on board several representatives of the Benjel Company. The trials were perfectly successful. The boat descended three times to a depth of a hundred feet, and each time remained submerged for at least an hour. On the first occasion, M. Piatti had a blacksmith as his companion. Some of the representatives of the company afterward descended and found that the apparatus operated perfectly and offered every security. The "La France" was afterward towed to the wreck of the "Compeador," a steamer that lies sunk at a depth of from 160 to 200 feet.

For the above particulars and the engraving, we are indebted to L'Illustration.



THE SUBMARINE VESSEL "LA FRANCE."

Submarine Photographs.

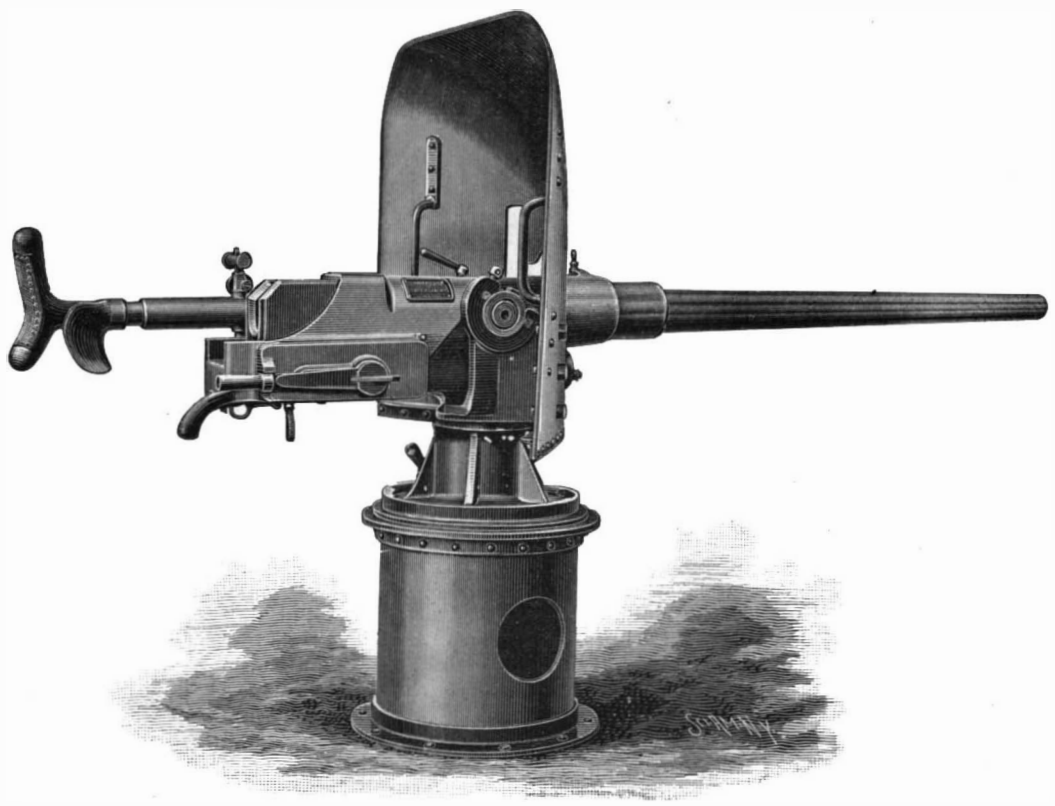
At a recent meeting of the Academy of Sciences, M. Louis Boutan, who is connected with the Arago laboratory at Banyuls on the seacoast, presented a series of instantaneous submarine photographs, taken with a camera 18 × 24 centimeters, having an anastigmatic objective and arranged to be operated under water. These plates have been obtained on a clear day when the sun was high in the horizon, and the results are very good; in several plates are clearly perceived bands of fish which have been taken at a distance of 1·50 to 2 meters from the objective, the camera being immersed to a depth of 3 meters. In order to form a background, a white screen was let down, before which bait was thrown in order to attract the fish into the field of the camera. This, however, is not indispensable, as on certain of the plates the fish are easily distinguished against the sandy bottom, and a diver placed against a background of seaweed, at a depth of 3 meters and a distance of 4 meters from the camera, gave a very good image. M. Boutan estimates that it is possible to take good instantaneous plates at a depth of 7 to 8 meters when the weather is favorable.

THREE-POUNDER SEMI-AUTOMATIC GUN.

The gun shown in the accompanying illustration forms part of the miscellaneous assortment of war material which was purchased in England in the early part of last year, when hostilities were threatening. It will be remembered that a government agent was dispatched in haste to buy up everything in sight in the way of ships, guns, and ammunition that would be suitable for our necessities, and it will also be remembered that the amount of purchasable material was surprisingly small. It had been popularly supposed that with the great financial resources possessed by this country we should be able at the approach of war to greatly strengthen our naval and military equipment at short notice. Our late experience has dispelled this illusion; for we found that other nations were very loth to part with ships and guns which, in the unsettled and threatening state of affairs, might be sorely needed by themselves. We were only able to purchase one completed modern cruiser, the "New Orleans," an out-of-date gunboat, the "Topeka," and a few rapid-fire rifles and machine guns of various patterns and sizes.

The semi-automatic gun, herewith illustrated, is one of four which were secured from the Maxim-Vickers Company. It is a gun which in the rapidity of its fire comes midway between the ordinary rapid-fire type of gun, of which the 6-pounder that did such good work in the late war is the most familiar to the American people, and the fully automatic gun, as represented by the Maxim 1-pounder, one hundred of which have just been finished for our navy at the Washington gun-shops. In the simple rapid-fire gun the three operations of opening the breech, inserting the cartridge, and closing the breech are done by hand. In the semi-automatic gun the opening and closing of the breech is done automatically, the only manual operation being the insertion of the cartridge, while in the fully automatic type the opening of the breech, insertion of the cartridge, extraction of the cartridge, and closing of the breech are carried on automatically and continuously by the gun itself as long as there is a feed of cartridges in the belt or hopper.

In the semi-automatic gun the first opening of the breech is done by hand, by pressing down the lever which is attached at the right hand side of the breech. When the gun is fired a portion of the powder gases enters a small cylinder, and, acting on a piston, serves to throw down the breech-block and eject the empty cartridge case. The act of pushing in a fresh cartridge disengages the breech-block, which is at once closed by a spring. The gain in time occurs through the substitution of automatic for manual closing and opening of the breech. It is not likely that this type of gun will be introduced on our battleships, for it is considered that the increased complication of the breech mechanism and the greater risk of disablement more than offset the greater rapidity of fire. Moreover, the gain in rapidity is not so great as might be supposed, for the speed of fire is determined by the rapidity with which the gun can be sighted, and as the loading in the case of the simple rapid-firer, has to wait on the sighting, it is not clear that any advantage is gained by the semi-automatic principle except in special emergency.



THREE-POUNDER SEMI-AUTOMATIC MAXIM GUN.

It has been suggested that, in view of the greater carrying power of the 3-pounder, it would be a better weapon to mount in the tops of our warships, and in this connection it is pointed out that very few hits were scored by the 1-pounders in the battle of Santiago. As a matter of fact, however, the 3-pounder, which weighs 1,440 pounds complete, and its saddle and stand, is too heavy and too cumbersome a weapon for the tops. It has also been suggested that, on account of its high velocity, rapidity of fire, and carrying power, the 3-pounder should replace the 6-pounders on the superstructure and bridges. This is not desirable, and indeed would be a step backward, for the tendency to-day is to greatly increase the weight of the secondary armament. In the British and Russian navies the 6-pounder has given place to the 12-pounder 3-inch gun, and it is probable that if a change is made on our ships it will be from 6-pounders to 12-pounders. The 12-pounder is a very formidable weapon at any of the ranges at which a naval fight is likely to take place.

The "Kaaba" and the Holy Carpet.

The "holy carpet," which has just been captured by the Bedouins while on its way from Cairo to the great mosque at Mecca, is really a covering for the "Kaaba," or "House of the Sacred Black Stone," that stands in the courtyard of the mosque. The "Kaaba," which is Arabic for cube house, is an oblong, massive structure built of fine gray granite, with a flat roof, and has the appearance of a perfect cube; hence its name. The only door is on the north side; it is about seven feet from the ground and is coated with silver. The Moslems believe that the original Kaaba was built in heaven two thousand years before the creation of the world, and that at the command of the Almighty, angels walked around it in adoration. Furthermore, they said that Adam built the first Kaaba on earth, on its present site, directly under the one in heaven. His sons repaired it, and Abraham rebuilt it after the Deluge. He needed a stone to fix in the corner, so he sent Ishmael out for one. The lad met the Angel Gabriel, who gave him the famous "black stone," which Moslems believe was once white but has become black on account of human sins. Long before the time of Mahomet, the Kaaba was a place of worship for the idolatrous Arabs, and in it they had no less than three hundred and sixty idols, one for each day of the Arabian year. The Arabs are naturally a most superstitious race, and when Mahomet found, after destroying the idols, that the custom of worshiping and making pilgrimages was not likely to cease, like a wise man he grafted its worship on to his own "ism," and now the pious Mussulmans still continue to make pilgrimages from all parts of the world to the shrine of the old Arabs. The "holy carpet" is the covering of the Kaaba and is renewed annually, and is made at the expense of the Egyptian government, and is forwarded to them with great ceremonies. This year, while being sent from Cairo to the great mosque at Mecca, it was captured by the Bedouins, who are holding it for a ransom of $3,000. It is made of eight pieces and the material is of coarse, black damask.

THE Dominion government telegraph line is now completed to Five Fingers, and is progressing so rapidly that it is believed that messages can be sent over the line to Dawson City by the middle of September. It is thought that a cable will be laid from Vancouver, B. C., to Skagway, Alaska, to connect with the new telegraph line. London capitalists desire the cable in order that the mining market may be in telegraphic communication with the gold fields.

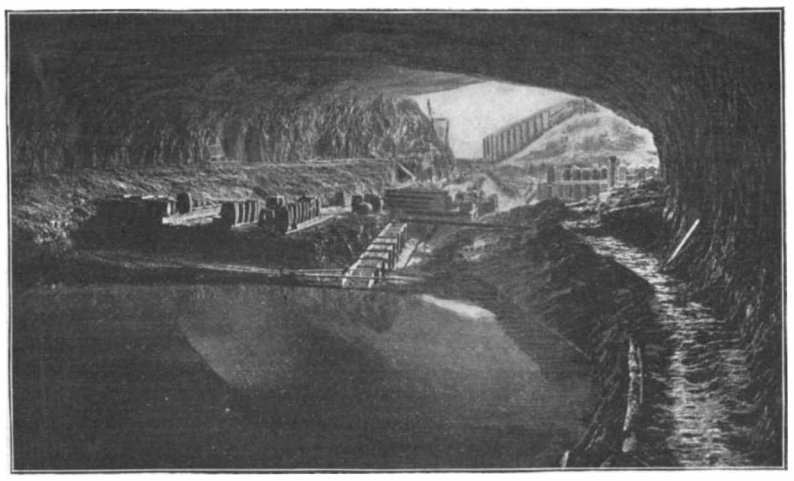
© 1899 SCIENTIFIC AMERICAN, INC.

A SUBTERRANEAN INDUSTRIAL PLANT.

In 1893, believing the time to be ripe for a demonstration of the practical operation of socialism, so far as it can be demonstrated in an isolated community, a paper published at Greensburg, Indiana, agitated the founding of a co-operative village or colony on the "Bellamy" principle, and the following season 1,000 acres of land were selected near Tennessee City, Tenn., as a site for a town. The land was covered with a fair quality of oak timber. The first members of the Ruskin Co-operative Association reached their new home on June 29, 1894, and the first thing which was done was to house their printing presses, which were to help in disseminating information regarding the new community.

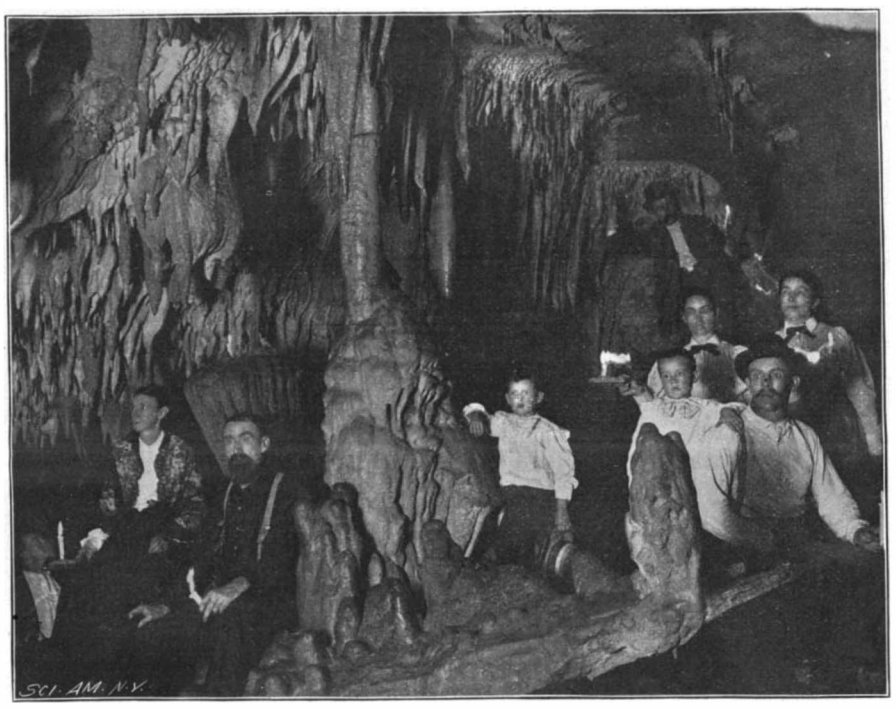
As soon as the printing office building was finished and wells were dug, the pioneers commenced operations on their own land and the first houses were begun. By July, 1895, twenty-five or thirty houses were erected and a common dining room was established where all could live much cheaper by eating collectively. A saw-mill was built, wagons, teams, etc., were purchased, a store was built and stocked and affairs went on smoothly until February, 1896, when a more attractive and productive location was secured, four and a half miles north of the old site. In 1897 the association moved to the new location, a building 50 × 100 feet having been erected for a printing establishment and for a common dining room. The results of their labors for the next three years were remarkable. The association built forty dwellings, four large buildings, and began several industries. Excellent schools teaching music, drawing, and painting were established, and a number of industries were carried on, so that on January 1, 1898, the gross assets amounted to over $78,000. The total number of acres the association owns or has the use of is 1,789. Members are received upon the payment of $500 in cash, and they are thereupon furnished with a separate home, but members can take their meals in the dining hall if desired. School privileges, houses, medical attendance, medicine, laundry, and shoe mending are furnished without charge by the association, which does not pay wages, but gives a maintenance fee to all members and members of their families. On taking possession of his home, a member begins to beautify it, knowing there is no danger of the landlord or mortgage holder absorbing the fruits of his labor.

The caves which are used by the colonists for canning and other industries are very interesting and are shown in our engravings. The Grand Cave and the Stalactite Cave are about a quarter of a mile distant. In the rear of the Grand Cave there is a lake of pure water coming from an unknown source. This abundant supply of water is conducted by a flume to a system of pipes and is forced by water power and steam pumps to a reservoir 183 feet above, where there is a Portland cement cistern holding 1,300 barrels of water. Two hundred yards to the rear of the Grand Cave a low passage leads to another chamber much larger; this forms the beginning of a series of chambers reached through small passages that have been measured by chains for a mile and a quarter back and explored for a much greater distance. The acoustic properties of the Grand Cave are excellent, owing to the fact that the vault is elliptical, and even a single violin will furnish music which can be heard throughout the whole cave; and on the Fourth of July two or three thousand people come from the surrounding towns to picnic in the cave and dance all day long in the cool atmosphere, which never varies from fifty-four degrees. The caves are used by the colonists as a canning and vinegar factory and a storehouse for canned fruits and their large celery crop. The caves seem to be splendidly adapted for storing of celery, and the Ruskinites are able to bring it out in the spring crisp and delicious. During the canning season the cave is the scene of great activity, immense quantities of food being prepared. It is estimated that it would require a building costing a hundred thousand dollars to equal the convenience and utility of the Grand Cave.



THE GRAND CAVE AND LAKE.

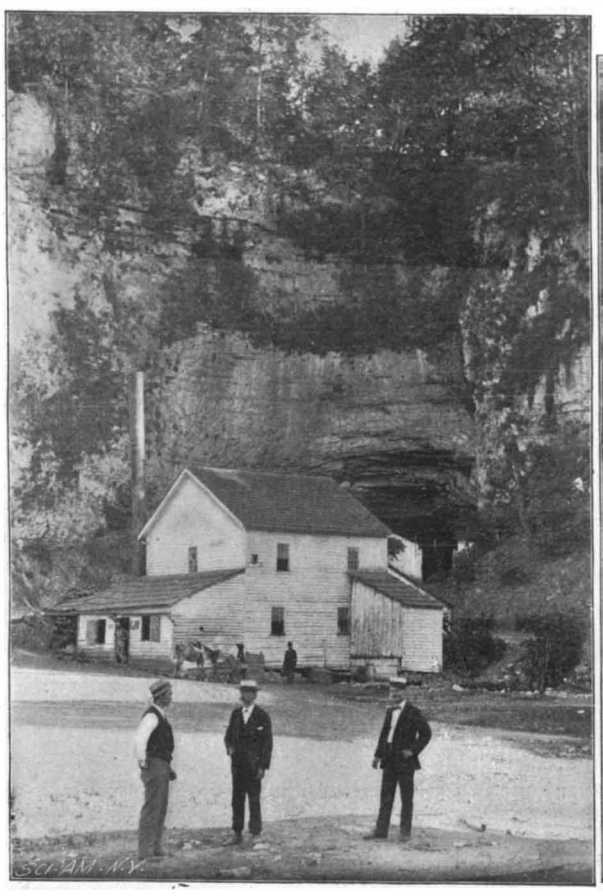
The Stalactite Cave, which we also show in our engraving, consists of several chambers running about 600 feet to a solid wall of stalagmites and stalactites that have united and formed columns and then massed themselves together so as to form a secure barrier to the chambers beyond. The water charged with carbonate of lime acting over a long period of time has deposited minute crystals and has formed the splendid examples of stalactites shown in our engraving, the dripping from the roof forming the stalactites, which depend from the ceiling, and the stalagmites, which rise from the floor, and the surface water continues its work in covering the rocks below with cascades of solid stone.



VIEW IN THE STALACTITE CAVE.

HUNTING FINBACK WHALES.—Dr. Frederick W. True, of the Smithsonian Institution, has just started for Newfoundland to hunt finback whales, his object being to secure specimens of these interesting cetaceans for the National Museum at Washington. A fishing station has recently been established on the coast of Newfoundland for carrying on the finback hunting industry. Until a short time ago this species of whale has not been recognized commercially, for although it yields a valuable oil as well as other useful products, it is a formidable creature to tackle, and the great beasts, seventy feet long, weighing thirty tons, are very hard to capture. It is said to be the most tremendous sport in the world, and tiger hunting is tame in comparison with it. Last summer Emperor William went to Norway to hunt this whale, and he declared it was the greatest sport he had ever had in his life. It is shot with a lance fired with a special gun located in the bow of the whaling vessel. A line is attached to the lance, and the whale keeps in motion until it is exhausted and finally captured. If possible one of the whales will be shipped entire to Washington. If this cannot be done, a papier mache cast will be made of the whale. Skeletons of others will also be obtained.

M. BONNIER, in a paper published in the Comptes Rendus, shows that plants which are subjected to alternations of extremes of temperature daily tend to have a more marked development of protective tissues, smaller and thicker leaves with a greater development of palisade tissue; there is also more assimilation per unit of surface and relatively large flowers slightly less colored than the normal. In other words, Alpine characters of plants can be artificially produced.



ENTRANCE TO THE GRAND CAVE.

THE GRAND CAVE USED AS A WAREHOUSE.

© 1899 SCIENTIFIC AMERICAN, INC.

Science Notes.

Since the new Tower bridge, London, has been built, the old Thames subway has fallen into disuse. It has been suggested that it be used for growing mushrooms. It would be an ideal spot for their growth.

An exhibition of the works of Van Dyck will be held in Antwerp, beginning August 12. There will be a loan exhibition from various galleries in Europe, and the event will be celebrated by a festival.

It is said that Capt. Pastorio, of the Italian headquarters staff, has discovered a means of rendering acetylene gas non-explosive. Press accounts are, of course, meager. Probably what is meant is that the gas is rendered safer to use, and not truly non-explosive.

Members of the scientific expedition to the fossil fields of Wyoming, to which we have already referred, have discovered bones of a brontosaurus, or great lizard. It is thought that this is one of the companions of the one discovered in Wyoming and restored in 1891 by Prof. Marsh.

United States Commissioner William A. Jones makes the interesting statement that "a full-blooded Indian lunatic never lived." After inspecting the site recently purchased by the government for an Indian Insane Asylum in the Indian Territory, he says, "The occupants of the hospital which will soon be opened will all be mixed breeds. Probably there never was a case of insanity in any tribe until the malady was introduced by mixing with the whites."

The United States Commission for the Paris Exposition will construct the necessary cases for the collective display of exhibits of agriculture, horticulture and food products in order that they may be uniform in design. All raw products which need preparation for exhibit will be sent to Washington to be selected and prepared, uniform glass jars and cases being used. It is hoped that by a system of refrigeration fresh food may be exhibited during nearly the entire period of the Exposition.

A few months ago we announced the fact that Prof. Charles F. Chandler, of Columbia University, would probably be elected president of the Society of Chemical Industry, of England, and he has now been elected to this important and responsible position. He is the first American to be elected president of an English scientific society. Prof. Chandler has occupied the chair of chemistry in Columbia University for many years, and in 1864 he founded the School of Mines of the College. He is known all over the world as an expert of high standing.

A serious pest has appeared within the last few years in the cotton fields of the South. It is spreading with great rapidity, and threatens to ruin the industry, if it cannot be successfully combated. The disease is a fungus which attacks the roots, causing the plant to wither and die. It is most destructive in the vicinity of Charleston S. C., and on the islands adjacent to the coast. The Department of Agriculture has appointed William A. Orton, a botanical expert, to investigate the matter, and it is hoped that a practical way of eradicating the pest will be devised.

An Italian, Signor Fabro, of Udine, Italy, has invented a new pneumatic sole for bicycle shoes, horseback riding, etc. In brief it consists of a rubber tube bent in a shape of a staple, or letter U. This is placed between the inner and outer sole and extends from the heel to a little past the center of the foot, where the tube is cut so as to form a bevel. The tube acts as a spring, and air is supplied to it at the back of the heel and at the lower ends of the tube. The back of the tube is also slit to allow a free circulation of air. It has been found that such a shoe is very valuable for use on long walking tours.

The experiment of using sea water for street sprinkling in the city of San Francisco appears to have been very successful. The water seems to cause the dirt to cohere more than fresh water between the paving stones, so that when it is dry a smaller amount of dust is raised by the wind. According to Appleton's Popular Science Monthly, it is claimed that when sea water has been used, one load of it is equal to three loads of fresh water. The salt which is deposited on the street absorbs moisture from the air during the night, whereby the street is thoroughly moist during the early morning, and has the appearance of having been freshly sprinkled.

Prof. J. H. Gore, of Columbian University, has been making interesting geodetic researches in Spitzbergen. Last summer he was enabled to make valuable pendulum tests in Spitzbergen. He landed with a single companion on Dane's Island near the spot where Andrée started on his balloon voyage. A small structure was built for the protection of the instruments and for an observation room. The wreck of the Andrée balloon-house furnished the best possible material for building purposes and for fuel. After making observations with the pendulum, the two scientists were taken off and in due time reached Norway. A full account of the expedition by Prof. Gore is given in the current number of the SUPPLEMENT.

Engineering Notes.

The new turbine vessel just constructed by the Elswick Works at Newcastle-on-Tyne is rather disappointing. On the first trial of the vessel, only 25 knots an hour was made instead of 40.

The old "Alaska," which has held the transatlantic record, has fallen from its high estate, and is being used as a dormitory by 400 workmen of Messrs. Vickers & Maxim, at their Barrow docks, who could not be accommodated in the boarding houses in the town.

When the bids were opened at the Navy Department on July 19, for the sale of six vessels purchased by the government at the beginning of the war, it was found that for the repair ship "Vulcan," which did such excellent service during the war, $175,750 was offered. The vessel was appraised at $100,000.

Thoria is, as far as the life of incandescent mantles for gas lights goes, perhaps the most important constituent, as there is no other oxide which will stand heat for so long a period without being affected by it, says Prof. Vivian B. Lewes, in an article on incandescent mantles published in the current issue of the SUPPLEMENT.

The report of the Interstate Commerce Commission for the year ending June 30, 1898, shows that the aggregate number of passengers carried during the year, as returned in the annual reports of the railways, is no less than 501,066,681, an increase of over 11,600,000. The number of tons of freight carried during the year was 879,006,307. This is an increase of 137,300,000 tons.

A frightful catastrophe is reported from Meran in the Austrian Tyrol. An inclined railway runs up the Schneeberg, and as a party of tourists were making the ascent the cable by which the car was moved broke, the brakes or the safety appliances did not appear to work, and the car was dashed to pieces in the valley below and several of the passengers were fatally injured.

The "Dahlgren," in her harbor trial on July 22, developed 29¾ knots. The course was the same over which the torpedo boat "Cushing" made her trial trip seven years ago. The trial was under forced draught, with four inches air pressure. The engines made 316 revolutions. Her builders, the Bath Iron Works, have no doubt as to the official trials, which take place in the course of a very few weeks. Her boilers easily maintained a steam pressure of 230 pounds.

The hull of the new torpedo boat destroyer "Bailey," which is being built by the Gas Engine and Power Company, at their works at Morris Heights, is rapidly nearing completion, and it is hoped that the new craft will be launched about July 29, when a favorable tide is expected. The machinery and boilers will not be placed in her until she is launched, and it is expected she will be ready for her speed trial in about a month after launching. We have already given the plans and details of the "Bailey."

A correspondent, of Nashville, Tenn., informs us that last year a new station was begun which was to cost $1,500,000. With other improvements eventually $2,000,000 will be expended, and the buildings are now well under way. The stone comes from the Bowling Green stone quarry, sixty-eight miles north of Nashville. Ample viaducts are being built, and the yard is a few feet short of a mile long and has a capacity of two thousand cars; there are some two hundred tracks in the yard. Thousands of those who saw the railroad depot during the Tennessee Centennial will be glad to hear of the new improvements.

A novel method of testing the efficiency of coverings for steam pipes electrically is in use. A section of the steam pipe is heated electrically by means of a coil of wire in oil within the pipe. The amount of energy necessary to keep the pipe at a definite temperature is measured. Since the energy supplied is just enough to maintain a constant temperature, it must therefore equal the heat lost from the pipe. Hence, from the electrical energy supplied the heat lost from the outside of the pipe can be calculated. The new method, which was recently described by Prof. Chas. L. Morton before one of the American learned societies, would seem to be worthy of attention.

Rear-Admiral Charles O'Neil, Chief of the Bureau of Ordnance of the Navy Department; Capt. A. H. McCormick, Commandant of the Navy Yard; and Commander Edwin C. Pendleton, superintendent of the gun shops at the Washington Navy Yard, have been made defendants in the Supreme Court in suits filed by Sir W. G. Armstrong, Whitworth & Co., Limited, the great English ordnance manufacturers, of Newcastle-on-Tyne. This company declares that they own the patent on trunnion bearings for ordnance originally granted to R. T. Brankston, which it is charged has been infringed in the recent manufacture of naval ordnance at the Washington Navy Yard. The company asks for $20,000 damages. This is one of the first instances of the prosecution of the Federal government for the infringement of a patent owned by a foreign corporation. A supplemental suit for $10,000 has been brought against Rear-Admiral O'Neil and Commandant Pendleton.

Electrical Notes.

A Wisconsin corporation has an option on a valuable piece of land at Matanzas, Cuba. Should they purchase it, they will erect a large electric lighting plant and a great warehouse.

The Bois de Boulogne, at Paris, will soon be lighted by electricity. This is important news, as it is high time that this park was well lighted, as a number of crimes have been committed in it under cover of the night.

A complete electric light plant has been installed at the Gluckauf salt mine, at Sonderhausen, Germany. The power is supplied by a current from the central station to all the mines and works. A current of 500 volts is used for driving steam winches and fans, and transformers reduce it to 220 volts for rock drills and electric lighting. The motors vary from 1¼ horse power to 105 horse power.

At Cripple Creek, writes a correspondent of The London Mining Journal, a miner can go to his work in an electric street car, descend the mine in an electric hoist, such mine being kept dry by an electric pump, do his work by an electric light, run drills operated by electric air compressors (soon to be superseded by electric drills) and fire his shots by electricity from a switch-board remote from the point of explosion.

The Diatto system, which is in use upon the tramways in Tours, France, belongs to the class in which the current generated in the central station is conducted to the cars along the line by means of contacts placed between the rails level with the ground. The first application of the system was made in Paris, the second at Monaco, and the third in Tours. A full account of the system will be found in the current number of the SUPPLEMENT.

The Braintree-Cohasset branch of the New Haven Railroad began running all its regular trains by the third-rail system on July 24. The part of the road from Braintree to Nantasket Junction has been running trains by this method for several years, and we have already fully described the system. The length of the new branch is twelve miles, and, according to Col. N. H. Heft, it will furnish a thorough test of the third rail system, and the result of the experiment will determine whether this system will be introduced on any other branches of the consolidated road or not.

A Massachusetts inventor has devised what The Railway Review calls a "mechanical rat." It consists of a piece of clockwork driving three rubber-tired wheels, which can be made to travel 400 feet by one winding of the spring. The diminutive automobile is first sent through the pipe to drag through a string, which can then be used to pull the wire or cable through, or pull a larger sized string or rope of sufficient strength to haul the cable. It is said that it is much more expeditious than the old method of running cables through conduits by shoving sticks coupled together into the pipe one at a time until the first stick reaches the other manhole. The little device described is small enough to be carried in the pocket. A number of years ago, in our SUPPLEMENT, we described a contrivance for taking wires through a large conduit, which was also interesting.

A New York lawyer recently made a trip from New York to Boston by trolley. The trip took twenty-nine hours, exclusive of stops. Two hundred and five miles were covered by trolley and fifty-two by trains hauled by steam locomotives. Thirty different lines were passed over. The country is now being gridironed with such an extensive series of trolleys that it is possible to take long journeys with comfort at minimum expense. There is no smoke, but little dust, and the transportation charges are usually much less than on steam roads. Speed is also reduced, so that the country can be well observed. All the northern part of Italy is covered with a network of steam tramway lines, many of which have now been converted to electric roads. Milan is the center of this system. It is possible to go from that city enormous distances by the "vapore," and it furnishes an ideal means for seeing the country.

During a thunderstorm early in the afternoon of June 19, a span of 120 telephone wires in Nuremberg were struck by lightning. These fell on the trolley wires of the electric tramways, the guard wires being naturally insufficient to bear their weight. The fuses in the telephone exchange at the end of the wires melted, and cut them off from the switchboard; but it appears that the heat of the fuses set fire to the top floor of the building itself, and it was only owing to the energetic action of the fire brigade that a serious accident was averted, for more than a thousand overhead wires enter the exchange at this point. The disturbance to the traffic on the tramway only lasted one hour and a half and affected three lines, while the 120 telephone subscribers whose lines were struck had their telephone service interrupted for two or three days. The above account was sent to the Elektrotechnische Zeitschrift by Herr C. A. Ankerson, the resident engineer at the Nuremberg electricity works, who happened to be an eye witness of the occurrence.

© 1899 SCIENTIFIC AMERICAN, INC.

ELECTRIC HEATING IN A CARMELITE HOSPICE.

The development of electrical power at Niagara Falls in vast quantities has resulted in the installation in the new Carmelite Hospice of an electrical plant for cooking and heating which has not its equal in the world. This hospice is located on the Canadian side of the river some distance back from the falls. It is on a bluff and from its windows a most magnificent view of the Niagara scenery is obtainable. Its location removes it from the circle of the falling spray cloud, but it is close enough to the cataract to secure the benefit of the electrical development made by the Canadian Niagara Power Company in the power station of the Niagara Falls Park and River Railway. This installation of the Canadian Niagara Power Company is a temporary construction, and in time will be supplanted by the magnificent development the company intends to make under the franchise it holds in Queen Victoria Niagara Falls Park.

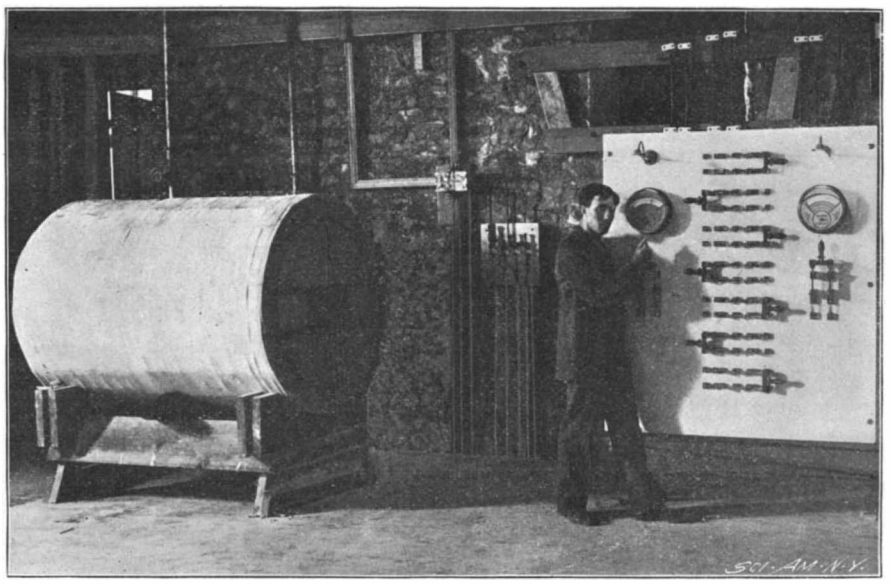
In the power station of the Niagara Falls Park and River Railway, the Canadian Niagara Power Company has installed two 1,000 horse power generators, the power from which is used for various purposes, but there has not yet been a demand of any magnitude for power on the Canadian side at Niagara. From this power station to the transformer house of the hospice, two miles, the current is conducted on bare copper wires. About 100 horse power is used in the hospice, 25 horse power for lighting, cooking, and heating water, and 75 horse power for heating the lower floor of the building.

In the transformer house of the hospice has been installed two 30 K. W. Westinghouse and one 25 K. W. General Electric transformer, primary 2,200 volts and three-phase secondary 110 volts, current being transmitted through underground cable to the switchboards located in the basement of the main building. One of these switchboards is shown in the illustration. The switchboard with double-throw switches controls two phases of the current, while the third phase is controlled by a switchboard adjoining the first one, and is used for cooking, lighting, etc. The arrangement of the switchboards is such that either transformer can be used independent of the other for either purpose.

The present building is but a wing of the structure contemplated in the plans of the Carmelite Fathers. In this building two hundred 16 candle power lights are used for illumination, and on the lower floor, which is heated by electricity, there are eleven bedrooms, a dining room, a reception room, and office. The corridor of this floor is 120 feet long, 10 feet wide, and 15 feet high. This corridor contains nine 4 horse power electric heaters, and in each bedroom, which is 10 by 12 by 15 feet, there is one 4 horse power electric heater with changeable heat switch of two heats.

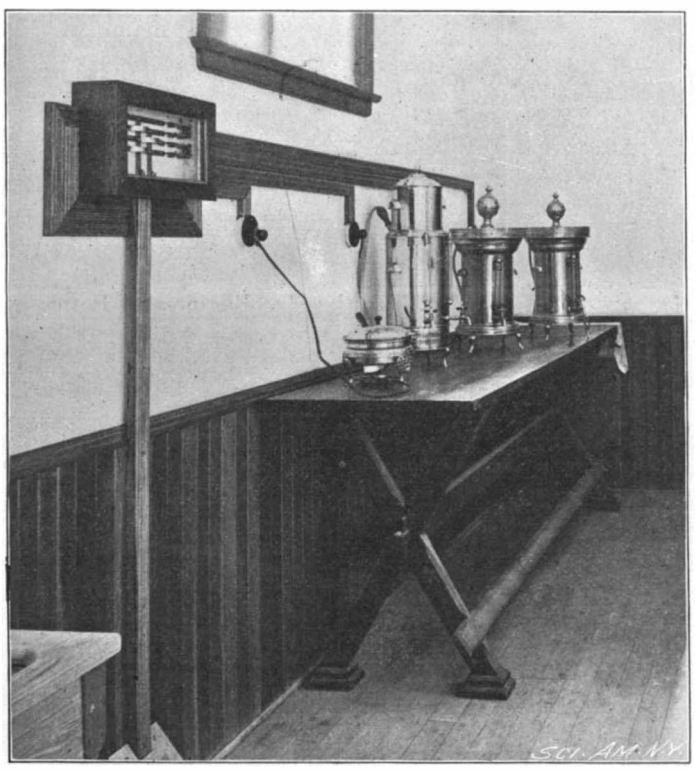
In the butler's pantry there are three 5-gallon urns and a chafing dish electrically operated. One of the urns is used for tea, one for coffee, and one for boiling water to supply the coffee and tea urns.

In the kitchen are to be found features that are most interesting. The range has a heating surface of 6 square feet, and each square foot of surface has a switch and can be controlled to full or half heat at the will of the operator or cook. The baking and roasting facilities are included in two small and one large oven. Each of the two small ovens has three compartments and consumes 23 amperes at 110 volts, while the large oven takes 50 amperes at the same voltage. This large oven is so arranged that it will roast four 25-pound roasts of meat at one time. Some idea of the work this equipment in this electrical kitchen will do may be gained from what was accomplished in it on June 15, the occasion of the blessing of the building and its formal opening for sacred purposes. At that time all the meats for two hundred and fifty people were cooked in two and one-half hours, while all the other cooking for the same number of people was done at the same time. This is with the exception of the soup, which was made the day before, as it requires many hours of attention to be good. As the heat of all the apparatus is uniform, the liability to burn is less than with other fuels. As the point of baking or roasting is plainly indicated, the cook can make no mistake. In the small ovens bread can be baked in 18 minutes.



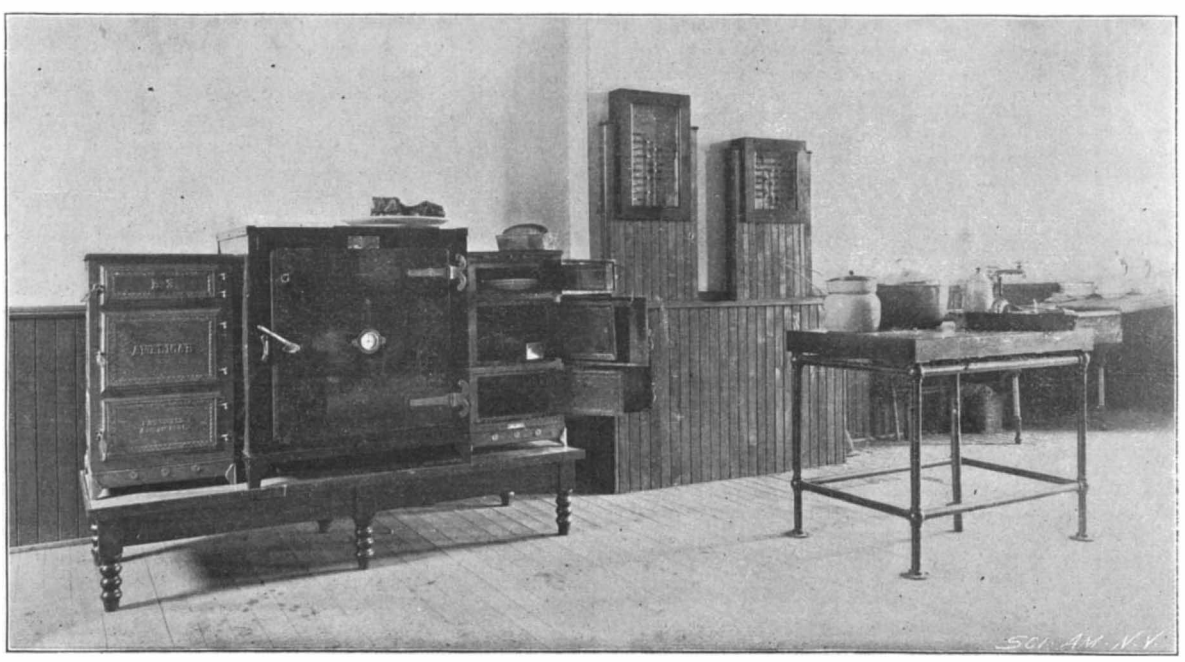
SWITCHBOARD AND 400-GALLON TANK FOR WATER HEATING.

In one of the illustrations, at the left of the switchboard will be noticed a large tank. This is the 400-gallon boiler in which water is boiled for the laundry and bathroom purposes. It takes a current of 120 amperes, being divided into three heats. Opposite this 400-gallon boiler, but not shown in the illustration, there is a 150-gallon boiler, in which water is boiled for kitchen purposes, but its services can also be used in connection with the large boiler. This small boiler takes 125 amperes for its operation, being also divided into three heats. This small boiler is used mostly for quick boiling. Both boilers are covered with 2½ inches of asbestos covering. An effort is usually made to boil all the water at the time the current is not being used for other purposes. In the 400-gallon boiler water is raised from 60° to 212° in six hours, with full heat.



ELECTRICALLY OPERATED COFFEE AND TEA URNS.

Naturally the main interest in this plant centers on the cost of the service; and here it may be said that the experience in the operation of the hospice plant can hardly be taken to form comparison with what the same service would cost elsewhere. This is because there are some exceptional features of cost found in this installation. The 25 horse power used for hot water heating, cooking, and for lighting purposes, cost $25 per horse power, but the 75 horse power used for heating the corridor and bedrooms is obtained at about one-fifth of this cost per horse power. It is evident that this power is not used the year around; and then another feature is that in the station of the Niagara Falls Park and River Railway there is always a surplusage of power in the winter time, as the business of the road is mainly a summer one. For this reason the same number of cars are not run in the winter as are run in the summer, and, therefore, not so much power is demanded from the power house.



KITCHEN OF THE CARMELITE HOME EQUIPPED WITH ELECTRIC STOVE AND OVENS.

The Expositions at Paris.

In view of the approaching French exposition, it will be interesting to note the enormous increase in the extent and success of the various expositions held at Paris.

The first occurred in the year 1798. It brought together the modest number of 110 exhibitors and cost only 60,000 francs. The buildings, of wood embellished, were erected on the Champ de Mars. Twenty-five medals were distributed.

The second took place three years later (1801) in the court of the Louvre. It represented 220 exhibitors and quite eclipsed the first.

A third exposition, opened the following year at the same place, collected 550 exhibitors. This was a veritable triumph.

Napoleon I. inaugurated the fourth exposition, which was held on the Esplanade of the Invalides in 1806; there were 1,422 exhibitors. This figure was carried to 1,622 at the fifth exposition in 1819, in the Palace of the Louvre. The sixth (1823) met with little success, as also the seventh in 1827 in the reign of Charles X., in the Palace of the Louvre. As an offset, the eighth, opened on the Place du Carrousel in the reign of Louis Philippe, gathered no less than 2,487 exhibitors. This success was accentuated in the exposition of 1839, held on the Champs-Elysées (3,381 exhibitors) and in that of 1844, also on the Champs-Elysées (3,960 exhibitors). The exposition of 1849, again on the Champs-Elysées, extended over a surface of 2,200 square meters and cost 6,000,000 francs.

The first universal exposition was that of 1855, which caused the construction of the Palace of Industry. The surface covered was 168,000 square meters and the expense rose to 11,500,000 francs. There were 23,954 exhibitors and more than 5,000,000 visitors. Then came the well known expositions of 1867 (52,000 exhibitors and 687,000 square meters), of 1878 (52,835 exhibitors and 16,000,000 visitors), and 1889 (55,486 exhibitors and 32,500,000 visitors).

Discoveries in Alaska.

The party of scientists who went to Alaska as the guests of Mr. Harriman are meeting with success, and have made several important discoveries. Among these is an immense bay extending inland for over twenty miles. At the upper end of this bay they discovered a great glacier inferior only to the Muir glacier in size. It has been named "Unknown Bay." Four other new glaciers which have never been seen by white men were found at the head of Disenchantment Bay. In Icy Bay an immense glacier was discovered, and was named "Harriman's glacier." New plant species have been found by the botanists, and the collection of marine species is expected to surpass any other yet made in the northern waters. Many other discoveries were made in bird life.

© 1899 SCIENTIFIC AMERICAN, INC.

A Notable Feat of Bridge Moving.

A notable engineering feat was performed a few days ago by the substitution of a new 500-ton drawbridge for an old and much lighter one where the Pennsylvania Railroad tracks pass the Passaic River near the Market Street station, Newark, N. J. The actual substitution of one bridge for another was made in eighteen and one-half minutes. The old drawbridge, which was built in 1868, was 213 feet long. The river at this point is 400 feet wide. At both sides of the river stationary spans are at the ends of the draw. The delay of traffic is, of course, most serious on a railroad like the Pennsylvania. It is easy enough to rebuild stationary parts, even where trains run over them every few minutes, but the substitution of one drawbridge span, weighing some hundreds of tons, for another, was a serious and interesting problem. When open the ends of the draw rested on fenders, which protect the structure from injury by passing boats. The engineers lengthened these fenders up and down the river until it was 250 feet long and capable of sustaining the weight of the draw. The new draw was erected on the southern fender, and it rested on eight railroad tracks, which in turn rested on rails. The space between the fenders and the central pier of the draw was filled with piling and capped with rails. Sunday was selected as the best day for doing the work, as then the traffic is the lightest. When the time came for moving, jacks were put under the old draw, and it was lifted clear of its pivot and raised to the level of the new one, and the two were lashed together with wire rope. Powerful hawsers were roved between blocks from the upper end of the old bridge to the drums of two stationary engines, which were started a few minutes after traffic was stopped. In eight minutes the old bridge was clear of its structure and moved onto the upper extension of the fender, and in another ten minutes the pivot of the new bridge was exactly over the socket, and in half an hour more the new bridge had been lowered on this pivot and the gear by which it is worked from an engine overhead had been fitted. The actual substitution of one drawspan for the other was made in eighteen and one-half minutes.

Repairs to the "Buffalo."

Repairs have been begun on the cruiser "Buffalo" at the Brooklyn navy yard. When they are completed, the vessel will be an excellent addition to the navy. She will be fitted for special transport duty between New York and Manila. The entire interior of the vessel will be remodeled and many improvements will be added. The engine room will be refitted and regular man-of-war quarters will be added. An ice machine will be introduced, and a larger evaporating plant has been purchased for the vessel. About $40,000 will be spent in these improvements, so that the ship will be worth at least $700,000. She will be painted white and fitted with a number of modern guns. We have already, on other occasions, given the history of this vessel.

Automobile News.

An automobile club is to be formed in Philadelphia.

Steam wagons are to be employed in hauling borax in Oregon.

According to The Motor Car Journal, the Austrian Ministry of Commerce is reported to be contemplating the introduction of motor cars for the conveyance of mail bags to and from the railway stations as well as for the delivery of parcel's post packages and the collection of letters from the pillar boxes.

The Matin's nine-day automobile race around France terminated at St. Germain on July 24. The winner was M. Réné de Knyff, a Belgian, who covered the distance (1,428 miles) in 44 hours, 44 minutes, 9 seconds, or at an average speed of about 32 miles per hour. In many parts of France the country was hilly and sometimes mountainous, and the carriages provided with the greatest horse power showed themselves to special advantage in hill climbing.

Mr. and Mrs. Davis have, owing to accidents to the machinery of their automobile, only reached Syracuse. The trip will be continued July 29.

Messrs. Haynes & Apperson, builders of an automobile of the same name, are making a trip from Kokomo, Ind., to Brooklyn. No attempt at fast time is being made and the average speed is fourteen miles per hour.

The automobile show at the Tuileries Gardens, Paris, has been very successful, and the number of vehicles shown has been very large and the exhibits are valued at over half a million dollars. The electric vehicles are particularly in evidence. Many of the French vehicles seating from two to three people rose in price from $700 to $1,200.

In France automobile accidents are becoming many and serious, and, unfortunately, the victims are usually the automobilists themselves. The former mayor of Ay, M. Bollinger, was riding in his automobile down a hill; they were going at a pretty good pace when the brakes failed, and suddenly the carriage, for some unaccountable reason, turned completely over, all the passengers being thrown underneath the vehicle. M. Bollinger was instantly killed and the others were seriously injured. In Belgium a well-known sportsman ran over a child with his motor cycle, broke the child's arm and leg, and he received a fractured skull. M. Pierre Giffard, an authority on the subject, attributes the alarming and constantly lengthening catalogue of accidents to excessive speeds which the drivers give their carriages.

The Current Supplement.

The current SUPPLEMENT, No. 1231, has many articles of unusual interest, the most important being "Geodetic Work in Spitzbergen," by Prof. J. H. Gore, an illustrated article of great interest. "Microbes in Co-operation" is by G. Clarke Nuttall. "New French Automobile Fire Engine" is described and illustrated with drawings, giving details of the mechanism. The usual "Trade Suggestions of the United States Consuls," "Miscellaneous Notes," "Selected Formulæ" and "Trade Receipts and Suggestions" are published. "Building Railways in the Field by the Railway Corps of the German Army" is an illustrated article showing how soldiers build railways in fields. "The Electric Tramway of the City of Tours" describes the Diatto system. There is also an interesting article on "The Nuraghi of Sardinia and Similar Structures." These are towers which compare in interest with the famous round towers of Ireland. They are of enormous size, and there are more than 3,000 on the island. "Some Experiments in Making Rubber Substitutes" is an interesting technical article.

Contents.

(Illustrated articles are marked with an asterisk.)

Alaska, discoveries in 91
Automobile news 92
Automobiles, motors for 82
Babbitt metal, melting 87
Books, new 93
Bridge, average life of metallic .. 82
Bridge moving 92
"Buffalo," repairs to the 92
Commercial needs 82
Consuls, activity of American 83
Dividing engine* 84
Dredges, steel 83
Electrical notes 90
Electric heating* 91
Electric storms, protection against 86
Engineering notes 90
Explosives, firing high 82
Exposition, Paris 91
Flue stopper* 84
Gun, three-pounder* 88
Heating, electric* 91
Industrial plant, subterranean* .. 89
Inventions, index of 93
Inventions recently patented 92
Kaaba and the holy carpet 88
Life saving appliance, prize for .. 83
Liquid air in medicine and surgery 83
Patents, British, in 1898 83
Pearl button industry* 81, 86
Photographs, submarine 88
Railway in China, American 82
Respiration, calorimeter* 85
Science notes 90
Submarine boat* 88
Submarine photographs 88
Subterranean industrial plant* .. 89
Supplement, current 92
Terms, use of scientific 86
Turbine water wheel* 84
Wagon tongue support* 84

RECENTLY PATENTED INVENTIONS.

Electrical Apparatus.

MEANS FOR PREVENTING SPARKING WHEN MAKING AND BREAKING CIRCUITS.—ADOLPH MÜLLER, Hagen, Westphalia, Germany. A circuit in which an electromotive force is opposed to that of the current source can be broken without sparking by increasing the opposing electromotive force until it equals that of the source of current before breaking the circuit. This is effected, according to the present invention, by introducing into the circuit, before disconnection, a battery of elements which easily becomes polarized. Such a battery is immediately polarized on entering the circuit to the tension of the current within the circuit; or it immediately increases any opposing electromotive force which may be present in the circuit until that force is equal to that of the source of current.

INCANDESCENT LAMP.—ANDREW H. MILLER, Central City, Colo. The filament of this incandescent lamp is in two sections and is associated with such connections as permit it to be cut in and out of circuit in a variety of ways, thus permitting the regulation of the power of the lamp. By means of the invention three distinct adjustments and hence three distinct candle-powers can be obtained. This renders the lamp especially desirable in hotels and hospitals where it is desired to vary the power of the lamp.

Mechanical Devices.

FLOOR-SURFACING MACHINE.—HENRY MCLOUGHLIN, Leavenworth, Kans. In the wheel supported frame of the machine a primary-movement shaft is mounted, having a slidable worm meshing with a worm-wheel. A clutch member fast to the shaft drives the worm. Gearing connects the worm-wheel with the wheels of the frame. In a swinging frame on the main frame cutting apparatus is mounted, driven by gearing from the primary-movement shaft. By means of this machine large areas of flooring can be quickly planed or true-surfaced without excessive labor.

Railway-Appliances.

CATTLE-GUARD.—JOSEPH W. ROSS, South Carrollton, Ky. The cattle-guard is of that form in which a railroad crosses a fence-line and is provided for some distance along its track with an impassable road-bed armed with spikes to prevent cattle from passing. The invention is distinguished from others of the same class by spiked zigzag plates having a bearing on the ties midway between their upper and lower angles. It is stated that thereby a convenient angle is obtained for driving the spikes, and that the ties afford a stiff backing for the plates at a point where they are especially weak and liable to be indented by the hoofs of animals.

LOCKING DEVICE FOR CAR COUPLINGS.—GEORGE P. STEWART, Palestine, Tex. Janney car-couplers are subject to accidental release of the knuckle from engagement with the opposite coupling. To prevent this, the inventor employs a transverse rockable lever loosely secured to the lower part of the key to control its upward movement. A pendent weighty dog on the draw-head is hung above the free end of the lever. The upward movement of the key is prevented until lever and dog have been simultaneously lifted.

SIGNAL-LAMP-RAISING DEVICE.—THOMAS J. WALSH, Walton, Ky. The object of the invention is to provide a simple apparatus to raise and lower signal-lamps at railway-stations, thus obviating the danger incurred in using the customary portable ladders. At the upper end of the signal-lamp mast a lever is pivoted from one end of which a pulling device extends downwardly, and by the other end of which a pulley is carried. A rope is passed around the pulley and connected with the lamp. By this arrangement, a lamp may be raised from the station or office.

Miscellaneous Inventions.

CISTERN.—WILLIAM J. SLACK, La Grange, Ind. The inventor has endeavored to provide an improved attachment for removing foul water and sediment from cisterns. The attachment is a casting formed with circumferential flanges to adapt it for forming a water-tight joint with the wall of the cistern, and with a central depression or cavity which is of conical form to adapt it to collect the sediment. A discharge passage is provided which communicates with the cavity, and which removes the sediment and foul water by siphonic action.

SWINGING-DOOR ATTACHMENT.—JOHN H. WHITAKER, Davenport, Iowa. Waiters in restaurants and hotels have a habit of kicking open swinging doors, thereby often upsetting their trays and dishes. The present invention provides an attachment consisting of a bracket secured to and extending outwardly from the door. A padded wheel is mounted to rotate about its vertical axis on the outer end of the bracket, and is arranged for engagement with the body or shoulder to open the door. Owing to the peculiar arrangement of the wheel, there is no danger of the door's swinging back against the waiter before he has passed through.

INVALID-BEDSTEAD.—ELMER C. SCRIBNER, Neversink, N. Y. The invention comprehends a novel construction of sectional bottom members having the foot portion formed of two longitudinal frames capable of being raised in unison or independently, and a single crank-operated mechanism, including shifting clutches to move into or out of operative position, whereby either one or both of the foot-frames can be elevated. The longitudinally-tiltable foot-frames are each made of two hinged sections, so that when elevated they may assume an angle shape to accommodate the bending of the invalid's knee.

CHURN.—HENRY G. SCHATZ, Commerce, Mo. The churn is provided with a vibrating dasher capable of being regulated to suit different churn-bodies. The dasher-shaft is reciprocated and vibrated by a worm-shaft operated by a handle. An end of the handle is pivoted on one end of a rocking lever, and is adjustable on the lever to shorten or lengthen the stroke of the worm-shaft.

PROCESS OF MAKING DRY PIGMENTS.—THOMAS J. O'SULLIVAN, London, Ontario, Canada. This process of producing dry pigment consists in saturating sawdust with an iron salt, and then drying or burning it. Sawdust being a waste material, it follows that the pigment can be very cheaply made.

FOLDING BED FOR VEHICLES.—THOMAS LOTHERINGTON, Dallas, Tex. The folding bed is provided with a bottom, and transverse supports for the sides having vertical locking members at their outer ends. Box sides are adapted to rest on the supports and engage the side edges of the bottom and the vertical locking members. Lock bars are removably secured to the sides and adapted to engage the vertical locking members and the underside of the bottom. The vertical locking members and lock-bars have engaging shoulders and lugs. The bed can be quickly and conveniently removed from the running-gear, to permit the bed's being changed from a wagon-box to a dray, or from a coal-car to a flat-car.

ACETYLENE-GAS LAMP.—GEORGE W. BAYLEY, Brooklyn, New York city. The lamp comprises an inner and outer casing. The inner casing contains carbid and has a pressure-controlled valve in its bottom for the admission of water. An annular, closed water-reservoir within the outer case is located above the carbid in the holder. A valve in the bottom of the reservoir provides a means for allowing the water to flow into the outer casing before being admitted to the carbid. A vent connects the upper part of the water-reservoir with the gas-space of the lamp.

SPOUT-GATE AND MECHANISM FOR OPERATING THE SAME.—HENRY F. KUSS, Escanaba, Mich. The invention is more particularly designed for use in connection with inclined spouts for discharging material from a dock into a vessel or from a platform into a car. The gate is mounted to swing vertically between supports at the discharge end of the spout. A locking-frame is mounted to slide in guides on the supports and is connected with the gate, so that when it is raised the gate will be opened.

WASTE-PIPE PLUG.—JOSEPH H. LITTLE, Manhattan, New York city. The present invention provides a chainless plug having a link attached thereto converging in a portion of its length and then diverging and having inwardly-turned hooks. In applying the plug, the link will be forced downwardly over a member of the strainer. The hooks will be spread apart so as readily to pass the member of the strainer. When water is to be retained the plug is inserted. When it is desired to draw the water the plug is pulled up until the contracted portion of the link comes above the strainer, the hooks preventing the total detachment of the plug.

FIRE-ESCAPE.—CHRISTOPHER PEEL, Manhattan, New York city. An upright ladder on the building is connected with foldable guard-walls above the ladder and adjacent to the windows of the building. The walls each have a foot-board foldable over an aperture thereof and adapted for projection beneath a window when the guard-walls are adjusted outwardly from the building wall.

BOILER-ATTACHMENT.—CHARLES W. SOMMER, Aberdeen, Miss. The attachment is especially designed for the collection and removal of sediment. The attachment comprises a pipe-line beneath the boiler, communicating at one end with the steam-space and having a blow-out at the other end. Hollow supports sustain the pipe-line and establish communication between the lower portion of boiler and pipe-line. A branch communicates with the pipe-line and extends upwardly into the boiler and has openings adjacent to the crown sheets. When sediment is forced through the pipe-line, a suction is created in the supports, so that any sediment remaining in the bottom of the boiler is drawn through into the pipe-line and forced out by the steam.

GAME.—WILLIAM A. WISSEMANN, Manhattan, New York city. The game simulates the battle of San Juan Hill and involves a fort or block-house over which a hostile flag is flying, the construction being such that by manipulating a number of balls so that they will enter the block-house, the supposed hostile flag will be automatically caused to disappear and an American flag raised.

ROTARY BRUSH.—PETER K. WESTERGARD, Orangeburg, N. Y. The brush is designed for the use of barbers and stablemen to remove impurities from the hair or scalp. The rotary brush is mounted in a frame and is secured to a vertical standard. On the standard a hand-wheel is journaled by which the brush is turned through the medium of bevel-gears. Beneath the brush a receiver is mounted which collects the impurities removed from the hair or skin.

HUB FOR VEHICLE-WHEELS.—CASIMIR C. BALLIN, Rue de Chateaudun 5, Paris, France. The invention is chiefly characterized by the interposition between the wheel-nave proper, which carries the spokes of the wheel, and the revolving socket supported on the axle, of an elastic non metallic pad or cushion, the soft body of which diminishes the force of the jolts. This pad is formed of two series of caoutchouc balls arranged concentrically around the central socket and in the first place tightly packed in a chamber or race. The pad is made in sections for permitting the movements of compression at the moment of the shock to be effected by simple displacement of the elastic material itself and not by rubbing on the walls which inclose it, as is the case with a continuous ring.

FIRE-ESCAPE.—JOSÉ DELGADO Y AGUILAR, Brooklyn, New York city. A strong yet simple device has been provided by this inventor for permanent attachment to the outside or inside of a building, which attachment affords a rapid means of escape from burning buildings irrespective of the number of floors. The invention consists of a simple arrangement of a bracket carrying a pulley around which an endless rope runs. At the lower end of the device a controller is provided which regulates the speed of the descent.

LIGHTING ATTACHMENT FOR VAPOR-LAMPS.—JAMES A. YARTON, Omaha, Neb. The invention relates to improvements designed for attachment to oil-gas burners of that kind in which a generator is heated by the flame of the burner; and it comprises essentially a carbureter of special construction which is designed to furnish a limited quantity of gas applied to heat the generator to working condition before the ordinary or service generator is brought into use.

HORSESHOE.—WILLIAM CAHILL, San Francisco, Cal. The horseshoe is especially designed for use on racing-horses. A light-metal plate is adapted to be attached to the horse's hoof to hold in place an elastic pad,

© 1899 SCIENTIFIC AMERICAN, INC.

which bears against the frog of the hoof. At its lower face the plate has a bar or shoe constructed and arranged with relation to the plate in such a manner as to protect the hoof more effectively than the devices heretofore provided.

SCREEN FOR STAMP-MILLS.—MARTIN R. DRISCOLL, Frisco, Utah. The mill has an apertured frame above which a roll of screen material is mounted, having a portion extending over the aperture. A clamping-frame extends about the lower and side edges of the aperture and covers the edge of the screen material. The frame has vertically-extending bolt-recesses in its side-bars, clamping-bolts within the recesses and an auxiliary clamping-bar engaging the outer face of the lower side of the clamping-frame. By loosening the clamping frames and bars the screen-cloth can be pulled down to bring an unused portion into use without stopping the battery.

SEWING-MACHINE SHUTTLE.—PERCY H. HEWITT, EDWIN A. COCKLE, and CHARLES MATTHEWS, London, England. An improved construction of shuttle is provided by these inventors, whereby the disadvantages incidental to the use of a special spool of small capacity are avoided. The shuttle has its case divided longitudinally into two parts, which parts are provided at their heels with interlocking projections and recesses engageable by a relative longitudinal movement of the parts and permitting a slight hinging action. One part has a transverse pin at its point and the other a longitudinal slot receiving the pin. On the point end of one part is a spring, engaging a catch on the other and straining the parts longitudinally to hold the interlocking parts in engagement.

WATER-WHEEL.—PATRICK HENRETTY, Belgrade, Minn. The water-wheel comprises pulleys provided at intervals with peripheral sockets. The bucket-chain used consists of a series of buckets equally flared on both sides of a central line and provided at their juncture with eyes. Through the overlapping eyes of adjoining buckets a shaft is passed, provided alongside of the buckets with rollers operating in the sockets of the pulleys. Links connect adjacent shafts outside the rollers.

SHANK FOR CORNETS.—WILLIAM H. HORN, San Francisco, Cal., and CHARLES L. WAIN, Kamloops, Canada. The shank is arranged to permit the performer to set his cornet to different keys without requiring separate shanks. The shank is made in two sections sliding one within the other, the outer section having a head with internal threads and the inner section having two external threads capable each of engaging with the threads of the head to hold the inner section in either one of two positions.

CHIMNEY TOP OR VENTILATOR.—JOSEPH A. HODEL, Baltimore, Md. The novel features of this invention are found in the effective method of securing the base-plate to the chimney by means of anchor-bars, in supporting the top carrying the cowl by means of strong slender standards so that no obstruction is offered to the free outlet of smoke from the flue-pipe, in securing the vane directly to the bearing-piece, while the guard-plate is held thereto by means of arms, and in the novel method of counterbalancing the guard-plate and vane. The merits of the invention lie in the uninterrupted passage provided for the smoke, in the prevention of downdraft, and in the counterbalancing of the moving parts.

Designs.

HAMMER-HEAD.—DANIEL S. WILLIAMS, Salida, and FREDERICK R. WATERS, Ouray, Col. The leading feature of the design is the form of the flared groove or socket in the side of the polygonal hammer-head.

ORNAMENTED STONE FOR JEWELRY.—JOSEPH L. HERZOG, Manhattan, New York city. The design consists of an elk's head produced upon a background of stone.

SHOE-LACE FASTENER.—GEORGE H. RICHARDS, Memphis, Tenn. To prevent the tearing of the shoe-lace and yet to hold the lace securely in place, the inventor forms the head of the fastener on its under side with a spherical surface.

CREAM-SEPARATOR.—CHARLES S. HANNA, West Hebron, N. Y. The design consists of a cylindrical body having a base and an inverted cone-shaped bottom terminating at its apex in a gage with a faucet.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE MANUFACTURE OF SAUSAGES. By James C. Duff, S.B. New York: National Provisioner Publishing Company. 1899. Pp. 131. 16mo. Price $2.

This is the first and only book on sausage making printed in English and there has been a considerable demand for a good book on this subject. The book will pay its cost many times over to even the smallest retail butcher, while to the sausage maker it will prove invaluable. Not only is information regarding meats, spices, casings, stuffings, etc., given in great detail but there are almost endless receipts for all kinds of standard and fancy sausages, some of the names of which recall far-away Strasburg and Nuremberg. It is an admirable book and the literature relating to provisions is so limited that we welcome every addition made to it.

DESCRIPTIVE MENTALITY FROM THE HEAD, FACE AND HAND. By Holmes Merton. Philadelphia: David McKay. 1899. Pp. 220. 8vo. 600 illustrations. Price $1.50.

It is probable that we all use physiognomy more or less to judge of character, and yet it is only reasonable to believe that those who are constantly engaged in studying this subject may carry it out to a remarkable degree. We do not believe that character can be told to any extent by the lines of the hand, but there are many people who think that it can, and to them the latter half of the book will undoubtedly appeal.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Gasoline Brazing Forge, Turner Brass Works, Chicago.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

"Criterion" Acetylene Generators, Magic Lanterns & accessories. J. B. Colt & Co., Dept. N, 3-7 W. 29th St., N. Y.

Ferracute Machine Co., Bridgeton, N. J., U. S. A. Full line of Presses, Dies, and other Sheet Metal Machinery.

Inventions developed and perfected. Designing and machine work. Garvin Machine Co., 141 Varick St., N. Y.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

The Milling Cutter Department of The L. S. Starrett Co. will be continued under the firm name of Gay & Ward, Athol, Mass. Owing to the increased business of the tool department, Mr. Starrett has withdrawn his interest in the milling cutter department, in order to devote his attention exclusively to the manufacture of fine tools. Messrs. Gay & Ward still continue to manufacture milling cutters under the immediate supervision of Mr. Gay, with increased facilities for producing an unsurpassed line of cutters.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7703) W. G. B. says: Have you published a formula for making an ink that would do to write on photographic negatives (for numbering them, etc.) with an ordinary pen? If so, kindly advise me the number of the copy in which the above formula can be found. A. To print the name on the photograph, several methods may be adopted. The simplest is to write the title of the subject on a slip of paper with aniline copying ink, or with ordinary copying ink mixed with gamboge or vermilion. Then slightly dampen the surface of the negative near the bottom right or left hand corner in as unobtrusive and unimportant a portion of the picture as possible. Press down the paper with the writing upon it. Leave for a few minutes and then remove the paper, when the writing will be found to have adhered to the negative. When printed, the name will print out white. Another way is to write backward on the negative, while another and better plan is to write the name in Indian ink on the surface of the paper before it is printed on. The ink will wash off in the after operations and leave the name in white where the surface of the paper has been protected by the ink.

(7704) J. W. M. writes: There has been quite a discussion here caused by your article on the 16-inch gun. The question is, "What is the fall of the curve of the water when looking one mile out to sea?" Or rather the ratio. For instance, the first mile view will have a fall of 8 inches. What will the second mile show? A. Allow for refraction of the atmosphere and the earth's curvature when looking out to sea:

For 1	mile	0·57 feet.
" 2	"	2·29 "
" 3	"	5·14 "
" 4	"	11·60 "
" 5	"	14·3 "
" 10	"	57·2 "
" 25	"	357·0 "
" 50	"	1429·0 "
" 100	"	5717·0 "

(7705) D McC. writes: Replying to J. W. B., No. 7689, of Notes and Queries, in SCIENTIFIC AMERICAN of July 22, 1899, would say that the "Magical" or "Mineral" sponge he inquires about is made of 25 pounds common whiting, 4 ounces powdered soap bark and 4 ounces powdered alum, thoroughly mixed and inclosed in a small cotton flannel bag (size to fit the hand), with the "fuzzy" side out and tightly sewed up. To use, thoroughly soak in water and rub article to be polished afterward rubbing dry with another cloth. After using the sponge (?) becomes dry and hard, but can be again used until worn out by pounding the cake inside the cloth to a powder.

(7706) J. J. H. asks: Will you please answer through your paper at what degree does aluminum melt and what metals it will melt with, and oblige a forty-six year reader of your paper. A. Aluminum melts at 625 degrees C. or 1,157 degrees Fah. It can be alloyed with copper, nickel, tungsten, manganese, chromium, zinc, tin, and titanium.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

JULY 25, 1899,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Accumulator plate, H. F. Hobel 629,363
Adding machine operating device, J. H. Lovering 629,381
Addressing machine, H. R. Grassmann 629,443
Aeration of liquids in bottles, means for effecting, K. S. Murray 629,752
Air brake, E. Bartholomew 629,708
Annealing furnace, A. Laughlin 629,510
Arch center, J. S. White 629,636
Back pedaling brake, F. H. Lippincott 629,514
Bar. See Typewriter's rack bar.
Barrel washer, J. Faust 629,743
Basin, wash, J. Totham 629,628
Batter machine, J. C. Roberts 629,607
Battery. See Secondary battery. Storage battery.
Bead adjuster, stop, U. G. McQueen 629,699
Bearing, W. D. Sargeant 629,395
Bearing, ball, L. Horn 629,564
Bearing for carpet sweepers, ball, F. C. Mason 629,518
Beater and sifter, J. C. Roberts 629,608
Bedstead ball, W. H. Perkins 629,598
Bench. See Work bench.
Bending structural shapes, machine for, S. E. Diescher 629,496
Bicycle, W. J. Otto 629,389
Bicycle driving gear, C. H. Sperle 629,622
Bicycle driving gear, C. Westall 629,635
Bicycle frame, T. D. McCall 629,585
Bicycle or like vehicle frame, L. B. Smyser 629,401
Bicycle pedals, etc., foot grip for, A. G. Tomkies 629,627
Bicycle seat post, H. T. Miller 629,697
Bicycle steering device, tandem, F. L. Bryant 629,335
Blank feeding device, C. H. Fogg 629,441
Blind, rolling, R. Richter 629,524
Boat detaching apparatus, hook for, C. Mackeprang et al. 629,383
Boat, life, J. Huebner 629,365
Boiler cleaner, W. H. Holcomb 629,563
Boiler furnace, A. P. Ritzos 629,606
Boiler furnace, down draught, F. Girtanner 629,350
Boiler tubes, means for fastening, T. Huberdeau 629,690
Boring and excavating implement, J. Bertram 629,539
Bottle, antirefilling, E. De Anguera 629,537
Bottle stopper, J. W. Smith 629,619
Box. See Garbage box.
Box fastener and seal, W. C. Rarig 629,523
Box or case, F. McIntyre 629,586
Boxes, apparatus for shaping lids of sheet metal, T. L. Carbone 629,546
Brake, H. J. Warmington 629,483
Branding cattle, liquid for, H. W. Scott 629,526
Bread board and holder, H. J. Abernathy 629,416
Brooch safety device, E. L. Logee 629,580
Brush, electrical hair, A. J. Cook 629,340
Brush holder support, R. N. Baylis 629,418
Buckle, belt, S. Bodwell 629,486
Burner. See Gas burner. Vapor burner.
Burner, H. M. Hamrick 629,355, 629,357
Cabinet or paper case, J. T. Hoyt 629,566
Cabinet, paper, J. T. Hoyt 629,565
Cameras, multiplying attachment for photographic, T. J. Burfield 629,542
Can. See Liquid holding can.
Can capping machine, Letson & Burpee 629,574
Can end forming die, J. M. K. Letson 629,575
Can for petroleum, etc., J. R. Bouhon 629,332
Cane and umbrella, combined, J. R. Nagell 629,460
Car coupling, J. W. Duty 629,344
Car coupling, P. C. Ewart 629,497
Car coupling, T. L. McKeen 629,587
Car coupling, I. Saddlemire 629,614
Car coupling, T. H. Smith 629,620
Car door, grain, Camehl & Foggitt 629,422
Car dust conveyer, C. B. Evridge 629,346
Car, street, W. T. Fernandez 629,498
Cars or vehicles, controller for electric motor, S. H. Short 629,398
Carbureter, F. L. Martenette 629,581
Card clothing foundation, E. Ashworth 629,326
Card shuffling device, F. C. Rollins 629,470
Carriage, baby, A. J. Horn 629,688
Cartridge loading machine, F. Raymond 629,393
Case. See Show case. Thread case.
Casein curd, method of and apparatus for treating, L. Axtell 629,644
Casting and conveying apparatus, Uehling & Miller 629,480
Casting machines, metal pot mechanism for, Nadall & Barr 629,459
Casting pipe, socket iron for, G. P. Bassett, Jr. 629,538
Ceilings, steel clip or hanger for, M. F. X. Foley 629,674
Chain, drive, B. J. Macdonald 629,515
Chair. See Reclining chair. Revolving chair. Rocking or lounging chair.
Chuck, automatic spindle, E. M. Couch 629,713
Churn, F. B. McKenney 629,588
Churn, N. J. Tubbs 629,479
Cigar cutter and advertising device, combined, A. A. Root 629,612
Cigar tip cutter and advertising device, combined, A. H. Lester 629,378
Circuit breaker, automatic magnetic, W. M. Scott 629,397
Circuit breaker, high tension, Davis & Wright 629,664
Clock lighting attachment, alarm, C. A. Robertson 629,609
Closet. See Water closet.
Closet ventilating and flushing apparatus, W. S. Brickell 629,709
Cloth clamp for textile machinery, A. W. Butterworth 629,741
Cloth clamp for textile machinery, H. W. Butterworth 629,491
Club, Indian, S. A. Taylor 629,626
Clutch, J. Brenzinger 629,651
Clutch mechanism, C. E. Bertels 629,328
Coating for metal structures, antifouling, G. D. Coleman 629,426
Cock, stop and waste, B. W. Boatenreiter 629,648
Coin controlled machine, C. A. Brewer 629,334
Color and making same, blue black disazo, Levinstein & Herz 629,748
Comb, I. D. Swindell 629,703
Commode, J. D. Farmer 629,434
Compass errors, device for correcting, J. Christensen 629,757
Compressing machine, F. B. Deane 629,716
Condenser, P. C. Hewitt 629,682
Consecutive view apparatus, J. Mason 629,582
Corn or other cereals, cleaner for, J. Q. Adams 629,484
Corner bending and forming press, F. Wuelfing 629,412
Cot, invalid, B. F. Cargill 629,658
Cotton press, F. L. Dyer 629,345
Coupling. See Car coupling. Hose coupling. Pipe coupling. Pipe or tube coupling. Thill coupling.
Culinary vessel, self draining, H. J. Carden 629,742
Cultivating and harvesting, power driven mechanism for, R. Romaine 629,385
Cultivating tool, W. H. Sharpe 629,475
Cultivator, S. H. & D. Garst 629,499
Cultivator, W. H. Traphagen 629,727, 629,729
Cultivator, Wilkins & Poe 629,639
Curtain holding device, G. H. Davis 629,550
Cutter. See Cigar tip cutter. Stalk cutter.
Cycle frame protector, A. R. Denbigh 629,667
Cycle speeding machine, A. E. Grosset 629,746
Cylinder lock, H. G. Voight 629,630
Damper lock, stove, T. F. Fallon 629,347
Dental articulator, Snow & Gritman 629,531
Dental dam, C. C. Allen 629,324
Dental plugger, G. B. Snow 629,621
Distilling petroleum, etc., apparatus for, A. Adiassewich 629,536
Document cover, C. H. Pope 629,601
Door check and closer, E. Cliff 629,494
Door holder, C. H. Ocumpaugh 629,753
Door opener, electric, A. F. T. Wiechers 629,638
Door, shutter, etc., J. M. Leaver 629,448
Draught excluder, P. Capon 629,711
Draughtsman's curve, C. A. Klintberg 629,569
Drawer equalizer, L. M. Miller 629,698
Drawing die, P. M. Haas 629,501
Drawing die for structural shapes, P. M. Haas 629,502
Drier, Manns & McDowell 629,384
Dyeing machine, hank, J. W. Crowther 629,715
Egg carrier, S. H. Houghton 629,506
Electric circuit plug receptacle, J. T. Hunt 629,445
Electric motor controller, Davis & Wright 629,665
Electric motor controlling apparatus, S. H. Short 629,399
Electric signal, W. H. Stillwell 629,624
Elevator buckets to their belts, means for securing, A. V. Allen 629,707
End gate fastener, F. A. Carlson 629,492
Envelop mucilating machine, R. E. Fischer 629,348
Excavating and coveying apparatus, F. B. Knight 629,695
Excavating apparatus, H. C. Lowrie 629,576
Exercising apparatus, W. J. Bryon, Jr. 629,655
Extractor. See Stump extractor.
Fare register, G. F. Rooke 629,471
Farm gate, G. A. Brown 629,420
Faucet, venting, L. Barger 629,327
Feed trough, W. Zonker 629,415
Feed water heater and purifier, G. W. Laughton 629,723
Feeding apparatus, boiler, J. Scott 629,615
Fence, portable, J. C. Simmons 629,529
Fence weaving machine, wire, G. W. Whittington 629,637
Fifth wheel, Griffin & Pullar 629,500
Filter press, J. Wilson 629,642
Firearm sight, G. Durrenberger 629,670, 629,671
Fire escape, J. I. Cranford 629,548
Fireproof and insulating material, A. Imschenetzky 629,567
Fireproof structure, J. Ray 629,468
Flushing apparatus, A. N. Pasman 629,463
Furnace door hinge, heating, J. A. Jensen 629,447
Furnaces, injector burner for hydrocarbon, G. Chelimsky 629,338
Fuse block for electric circuits, H. P. Davis 629,663
Fuse, shell, Dawson & Buckham 629,552
Gallocyanin-leuco derivative and making same, De la Harpe & Vaucher 629,666
Garbage box, E. E. Canedy 629,710
Garment, I. Goldberger 629,678
Garment supporter, C. C. Hansen 629,358
Gas burner, F. A. Cortis 629,430
Gas burner, acetylene, D. M. Steward 629,623
Gas furnace, J. C. Swindell 629,478
Gas generator, acetylene, T. O. Bateman 629,485
Gas generator, acetylene, W. J. Baulieu 629,738
Gas generator, acetylene, J. B. Holmes 629,720
Gas generator, acetylene, J. M. Schofield 629,701
Gas generator, acetylene, H. J. Volz 629,481
Gas, producing and liquefying acetylene, Dickerson & Suckert 629,668, 629,669
Gas purifier, W. J. Baulieu 629,739
Gas washer, H. J. Smith 629,400
Gate. See Farm gate. Water gate.
Gate, S. D. Hathaway 629,360
Gate, W. M. Kent 629,509
Gate, T. Wortman 629,766
Glass bulbs, tool for manufacturing, F. Fanta 629,555
Glass furnace, E. Ford 629,557
Gold dredger elevator, R. H. Postlethwaite 629,602
Grain binder knotting device, C. A. A. Rand 629,522
Grain cleaner, G. Wellington 629,407
Grain hulling and polishing machine, A. B. Couch 629,547
Graphophone mandrel, R. Wolf 629,534
Gromet or eyelet, R. M. Popham 629,754
Guns, breech mechanism for rapid fire, F. F. Fletcher 629,673
Guns, firing and extracting mechanism for breech loading, Dawson & Buckham 629,551
Handkerchief holder, L. M. Churchill 629,660
Hanger. See Lamp hanger.
Harrow, C. A. Brostrom 629,652
Harrow and clod crusher, rotary, W. M. Cook 629,428
Harrow and cultivator, J. A. Underwood 629,629
Harrow, rotary, W. Seckler 629,474
Harvester knife fastener, W. C. Bush 629,656
Heat regulating device, F. Lamplough 629,375
Heating liquids, R. L. Mond 629,520
Hides, apparatus for treating, J. R. & J. S. Brown 629,490
Hinge, W. Schuch 629,396
Hoisting jack machine, M. J. Graham 629,352
Hoisting machine, portable, C. A. Bassett 629,737
Hook, K. Williams 629,640
Hook sizing and flaring machine, H. O. Hem 629,444
Hose coupling, air brake, J. Cadwell 629,657
Hose supporter, R. W. Parramore 629,391
House. See Smokehouse.
Hub, carriage wheel, D. Quintal 629,467
Hub for wheels, split, J. J. Scholfield 629,525
Hydraulic apparatus, S. Robertson 629,611
Index, B. D. Le Gras 629,573
Indicator. See Station indicator.
Inhaler, W. Wagner 629,482
Injector, steam boiler, L. E. Hogue 629,562
Insulated conductor, J. N. Keller 629,508
Joint for parts of machinery, A. C. Culver 629,549
Junction box cover, Kern & Claflin 629,373
Knitting machine, J. D. Hemphill 629,503
Knob attachment, W. A. Gibbs 629,755
Ladder or telescoping water tower, fire, J. F. Chazotte 629,493
Ladder, step, J. Owen 629,589
Lamp, arc, E. M. Cashion 629,424
Lamp bracket for miners' caps, T. R. Jones 629,692
Lamp, electric arc, P. F. H. Queisser 629,603
Lamp, electric headlight, H. P. Wellman 629,631
Lamp hanger, adjustable incandescent, Thorp & Normart 629,406
Lamplighting device, F. A. Cortis 629,431
Lamp or lantern, street, V. O. Hammon 629,353
Lasting machine, W. H. Dorman 629,553
Lasting machine, boot or shoe, A. E. Stirckler 629,476
Leather scouring and setting machine, Holmes & Bradford 629,687

(Continued on page 94)

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

WOOD or METAL WORKERS
without steam power can save *time* and *money* by using our
Foot and Hand Power Machinery
SEND FOR CATALOGUES—
A—Wood-working Machinery.
B—Lathes, etc.
SENECA FALLS MFG. COMPANY,
695 Water St., Seneca Falls, N. Y.

POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Queen Transits and Levels
High Grade Instruments with the Latest Improvements.
160 page Engineering Catalogue on application.
THE QUEEN
240 page Mathematical Catalogue on application.
ENGINEERS' AND DRAFTSMEN'S SUPPLIES.
QUEEN & CO., Optical and Scientific Instrument Works,
59 Fifth Ave., New York. 1010 Chestnut St., Phila.

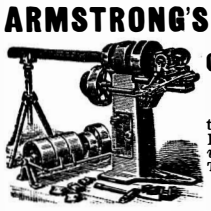
THE FORBES PATENT DIE STOCKS.
Two and three inch pipe can be threaded by a boy using only one hand on a crank.
☞ *Send for illustrated catalogue*
CURTIS & CURTIS,
No. 30 Hand Machine. Range ¼ to 2" R. & L. 6 Garden St., Bridgeport, Conn.

BARNES'
UPRIGHT DRILLS

Complete line, ranging from Light Friction Disk Drill to 42" Back Geared Self-Feed. ☞ *Send for New Catalogue.*
W. F. & JOHN BARNES CO.
1999 Ruby Street, ROCKFORD, ILL.

© 1899 SCIENTIFIC AMERICAN, INC.

ARMSTRONG'S PIPE THREADING
—AND—
CUTTING-OFF MACHINES



Both Hand and Power.
Sizes 1 to 6 inches.
Water, Gas, and Steam Fitters' Tools, Hinged Pipe Vises. Pipe Cutters. *Stocks and Dies universally acknowledged to be* THE BEST. ☞ *Send for catalog.*
THE ARMSTRONG MFG. CO.
Bridgeport. Conn.

Physical and School Apparatus
GALVANOMETERS

STANDARD, SINE, TANGENT, REFLECTING and WIEDEMANN GALVANOMETERS . . . . .
Catalogue free.
E. S. Ritchie & Sons, Brookline, Mass.

WHEN DID IT HAPPEN?

Don't be in doubt if it is a matter of importance in business. Be **sure** of the time by recording it with the **AUTOMATIC TIME STAMP.** It records the exact second, minute, hour, day and month; also imprints the owner's name and the nature of the transaction. Indispensable in all offices, workshops, factories and banks. Every business house should have one. Run by clockwork. Can't get out of order. Absolutely reliable. ☞ *Send for illustrated circular.*
AUTOMATIC TIME STAMP CO.,
160 A Congress St., Boston, Mass., U. S. A.

WOODWORKING MACHINERY.

For Planing Mills, Carpenters, Builders, Furniture, Chair, Vehicle, Wheel and Spoke Makers, etc.
☞ *Correspondence Solicited.*
Illustrated 312-page Catalogue free to manufacturers and foremen.
THE EGAN CO.
327 to 347 West Front Street, CINCINNATI, OHIO.

NEVERSLIP TRADE MARK.
Bar Belt Dressing

It gives a smooth, pliable and adhesive surface, and saves Belts, Power and Wear of Machinery Bearings. Also adapted to Canvas and Rubber Belts. Box of 12 Bars, $3.00, sent on Trial.
The White & Bagley Co., Worcester, Mass., U. S. A.

THE COBURN PATENT TROLLEY TRACK
HOUSE DOOR HANGERS

The first made with adjustable track.
The track can be put up in 30 minutes.
☞ *Send for Book.*
The Coburn Trolley Track Mfg. Co., Holyoke, Mass.

IGNITION OF GAS or GASOLINE ENGINES

solved by the use of our Dynamos Types R and S. Weight of Type R 13 lbs. Speed, 1400 R. P. M. Type S for stationary work; weight 47 lbs., speed 1,400 R. P. M., height 10 inches. No spark coil required with either. *Send 2c. stamp for illus. catalogue.* ELBRIDGE ELECTRICAL MFG. CO., Elbridge, N. Y., U. S. A.

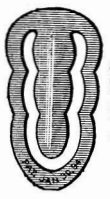
WORKS LIKE A CHARM.

Perfect satisfaction is experienced using our No. 5, 6 or 9 **Hand Pipe Threading and Cutting Machines.** Crank or ratchet power. Gears housed from dust. Chasers set by graduation to any size, can be released from threading while in motion, opened to permit pipe being cut, and instantly closed.
☞ *Send for Free Catalogue to*
The Merrell Manufacturing Co., 501 Curtiss Street, Toledo, Ohio.

Friction-Clutch Pulley

Use Taper-Sleeve Pulleys
The Best in the World. **Solid-Web Iron-Center Hardwood Dynamo Pulleys** prevents Slipping of the Belt. **Friction-Clutch Pulleys,** for connecting and disconnecting Gas and Steam Engines, Lines of Shafting, Dynamos, Generators and Machinery of all kinds without slacking speed of motive power. State your requirements and *write for catalogue "S."*
THE TAPER-SLEEVE PULLEY WORKS, Erie, Pa., U.S.A.

THE EUREKA CLIP



The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**

Van Norman Duplex Milling Machines

Perform the combined work of **Horizontal Spindle Milling Machines, Vertical Spindle Milling Machines,** and in addition, *cut at all angles.* They are invaluable for all kinds of tool, gauge and fixture work, die work and for general manufacturing. They save time, cutters and fixtures.
WALTHAM WATCH TOOL CO.,
Springfield, Mass.

MANUFACTURE OF BICYCLES.—A very comprehensive article giving the details of construction of every part of these vehicles. With 15 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **908.** Price 10 cents. To be had at this office and from all newsdealers.

DEFIANCE MACHINE WORKS

DEFIANCE, OHIO, U.S.A.
BUILDERS OF
HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE AND HOOP MACHINERY.
SEND FOR CATALOGUE

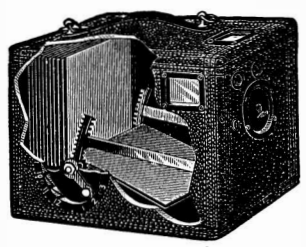
Adlake Cameras

Have Simplified Photography.

ADLAKE BOOK FREE for a postal; tells all about Adlakes.

FREE WITH ALL ADLAKES:

New Adlake Metal Shutter.
Portrait Attachment.
Device for making Panoramic Pictures.
New Multiplex Attachment for taking 2 to 4 pictures of same object in different positions on one plate, **$1.00** extra.



Adlakes are best for Everyone but Professionals.
Sent, express paid, anywhere in U. S.

Adlake Regular, 3¼x4¼,	With 12 Metal Light tight Plate Holders.	**$ 6.50**
Adlake Regular, 4x5,	With 12 Metal Light-tight Plate Holders.	**10.00**
Adlake Special, 4x5,	With 12 Aluminum Light-tight Plate Holders.	**12.00**
Adlake Repeater, 3¼x4¼,	Takes 12 pictures in 10 seconds, if you wish.	**5.50**
Adlake Repeater, 4x5,	Takes 12 pictures without opening the box.	**8.00**

Glass Plates cost half the price of Films.

THE ADAMS & WESTLAKE CO., 108 Ontario Street, CHICAGO, Makers of Adlake Bicycles, X-Rays Cycle Oil Lamps, Adlake Acetylene Cycle Lamps.

Ledger balance sheet, H. Swalley	629,404	
Lenses, apparatus for shaping and beveling edges of glass, J. West	629,634	
Liquid holding can, G. Lambert	629,571	
Lock. See Cylinder lock. Damper lock. Nut lock. Sash lock.		
Lock, L. Martel	629,453	
Locomotives, bell ringer for, E. M. Crandall	629,662	
Looms, motor apparatus for, Herrick & Brock	629,504	
Lubricating device, S. O. Jones	629,369	
Lubricator, G. U. Merrill	629,583	
Lubricator, W. P. Phillips	629,465	
Mail pouch closure, W. A. Piatt	629,599	
Match safe, J. Bond	629,649	
Mechanical motor, H. S. Durand et al	629,343	
Mechanical movement, Protheroe & Man	629,392	
Metal shearing machine, B. Wesselmann	629,632, 629,633	
Metals, apparatus for shaping, forging, drawing, solidifying, and squirting, J. Robertson	629,610	
Metallic compounds and producing metallic carbids, reducing, I. L. Roberts	629,394	
Metallic plates or sheets, etc., machinery for shearing or cutting, H. S. Thomas	629,532	
Mining machine, gold, T. S. Quackenbush	629,466	
Mitering machine, G. Clemens	629,425	
Moulding purposes, composition of matter for, R. Platz	629,600	
Morphin, making alkyl ethers of, A. Ehrenberg	629,433	
Motor. See Mechanical motor.		
Muff lining, M. Maguire	629,579	
Music sheets of self-playing instruments, mechanism for driving, F. W. Hedgeland	629,361	
Nut lock, H. Berschneider	629,647	
Nut lock, F. O. Skelly	629,530	
Oar, bow facing, Steele & Olson	629,402	
Ore and coal separator, F. Pardee	629,590	
Ore, coal, etc., separator for, F. Pardee	629,590 to 629,597	
Packing, folding, W. C. Loeffel	629,450	
Packing ring, piston, W. E. Karns	629,693	
Paint spraying device, E. Liebscher	629,513	
Painting apparatus, J. H. Davis	629,756	
Pans, automatic alarm for drip, E. Hicks	629,683	
Paper bag machine, M. Schenck	629,472	
Paper drying machines, lath carrying device for, S. R. Liberty	629,696	
Pegging machine, A. G. Leonard et al	629,512	
Pen, fountain, S. J. Meyerpeter	629,519	
Penholder attachment, C. A. Faust	629,436	
Pen or trap, animal, J. D. Fox	629,675	
Pendulum beat adjuster, H. D. Keeler	629,370	
Pew rope and lock, Clark & Wattson	629,661	
Piano action, grand, J. Herrburger	629,362	
Pin. See Spoke pin.		
Pipe. See Tobacco pipe.		
Pipe carrier, B. F. Williston	629,408	
Pipe coupling, train, J. Redfern	629,469	
Pipe or tube coupling, C. L. Travis	629,705	
Placket fastener and belt retainer, combined, Hildebrandt & Oesterla	629,684	
Planter, corn, Mahaffey & Work	629,749	
Planter, corn, W. H. Traphagen	629,720	
Plow, C. E. Anderson	629,643	
Plow stock, E. H. Westbrook	629,533	
Plow, wheeled, G. Jernberg	629,722	
Plow, wheeled, L. E. Waterman	629,732, 629,733	
Post. See Bicycle seat post.		
Power transmitter, R. F. Nichols	629,461	
Press. See Cotton press. Filter press. Printing press.		
Printing press, T. M. North	629,388	
Printing wheel for time recorders, record, Hull & Burchett	629,366	
Propeller, chain, L. Kohn	629,570	
Pulverizer, J. A. Coons	629,712	
Pump, R. Luhn	629,577	
Pump, H. S. Maxim	629,750	
Pump, filter, H. Nordtmeyer	629,387	
Pumps, steam actuated valve for, J. McCulloch	629,386	
Punch, metal, J. Gogley	629,558	
Punching die, T. Corscaden	629,429	
Puzzle, A. & A. A. Shepherd	629,527	
Rack. See Towel rack.		
Racking apparatus, barrel or cask, J. J. Marshall	629,517	
Rail breaking machine, Baumhoff & Schmid	629,417	
Rails, rerolling, J. E. York	629,413	
Railway, King & Babendreier	629,568	
Railway switch operating mechanism, Young & Morden	629,414	
Railway system, third rail electric, J. R. Farmer	629,435	
Reclining chair, C. E. & D. W. Brower	629,540	
Recorders or registers, number assembling device for, J. W. A. Gardam	629,349	
Reflector, L. Huntze	629,691	
Refrigerating apparatus, M. Cooper, Jr	629,341	
Refrigerating apparatus with ammonia solution, apparatus for charging, W. W. Harris	629,359	
Refrigerator or cold storage receptacle, R. Laupheimer	629,572	
Register. See Fare register.		
Register or ventilator, R. R. Buehler	629,336	
Regulator. See Valve regulator.		
Retort, rotary, F. W. Smith	629,617	
Revolving chair, J. M. Germanson	629,676	
Ring. See Packing ring.		
Rocking or lounging chair, G. Kelly	629,694	
Rolls, guide for, W. Garrett	629,718	
Saddle, gig, C. A. White	629,734	
Sash holder and fastener, Guynes & Flores	629,679	
Sash lock, A. Rosenkranz	629,613	
Sawing machine, C. J. Manning	629,516	
Scow, dumping, F. P. Eastman	629,554	
Scraper, J. T. Boufford	629,487	
Scraper, wheeled, G. W. Lovejoy	629,452	
Screw machine chucks, device for automatically feeding articles to, E. M. Couch	629,714	
Seal, car, A. La Veen	629,511	
Secondary battery, R. Ashley	629,325	
Seeder, Dodds & Jackson	629,342	
Separator, A. Raymond	629,604	
Sewing machine, Ammerman & Toof	629,735	
Sewing machine, hemstitch, Brown & Quinn	629,421	
Sewing machine ruffler attachment, Ammerman & Toof	629,736	
Shade fixture, window, G. W. Horn	629,364	
Shears, G. M. Clapper	629,339	
Sheet carrier, slip, J. A. Farrington	629,556	
Sheet metal can bodies, machine for flanging, J. Brenzinger	629,650	
Shelving, traveling, A. Symes	629,704	
Shovel, H. Mikkola	629,456	
Show case, E. Fadum	629,672	
Shutter or blind, window, G. H. Hamalian	629,680	
Signal. See Electric signal.		
Skirt supporter and shoulder brace, K. Williams	629,641	
Smoke house, C. A. Glocker	629,351	
Smokeless furnace, Brown & Moore	629,654	
Snap hook, G. M. Hubbard	629,689	
Snow plow, S. G. Bush	629,543	
Spindle bearing, J. Kilburn (reissue)	11,761	
Spinning machine roving stop motion, F. S. Culver	629,495	
Spoke pin, C. H. Veeder	629,731	
Stalk cutter, W. H. Traphagen	629,728	
Stall, portable, D. Stitzer	629,726	
Stamp, time, E. R. Malmborg	629,580	
Staple setting implement, C. H. Schmidt	629,473	
Station indicator, F. H. Rees	629,605	
Station potential indicator, R. D. Mershon	629,584	
Stereotype plate, W. H. Caps	629,423	
Stopper. See Bottle stopper.		
Storage battery, C. W. Kennedy	629,371, 629,372	
Stove, combined air tight wood and coal, F. M. Cadman	629,544	
Stove or furnace grate, J. H. Goodfellow	629,719	
Stove or heater, gas, S. N. Mentel et al	629,454	
Stud or hook, lacing, A. S. Neumark	629,724	
Stump extractor and conveyer, N. Champagne	629,659	
Suspenders, C. Janton	629,507	

(Continued on page 95)

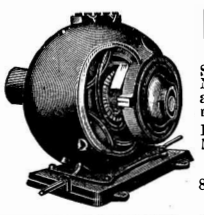
Chain

BELTING of Various Styles, ELEVATORS, CONVEYORS,
COAL MINING and HANDLING MACHINERY.
The JEFFREY MANUFACTURING CO., COLUMBUS, O.
☞ *Send for latest complete Catalogue.* New York Branch, 41 Dey Street.

ROCK DRILLS
AIR COMPRESSORS
SIMPLEST, MOST EFFICIENT and DURABLE.
RAND DRILL CO.
Send for Catalogue. 100 Broadway, New York.

DON'T SEW ON BUTTONS!

Bachelor's Buttons made with **Improved Washburne Patent Fasteners** slip on in a jiffy. Press a little lever—they hold like grim death, but don't injure the fabric. Instantly released when desired. By mail, 10c. each. Illus. catalogue showing collar buttons and other useful novelties made with these fasteners, free on request.
American Ring Co., Box P, **Waterbury, Conn.**



Dynamos—Motors.
Multi-Polar Iron-Clad Type. Slow and Moderate Speeds. A Modern Machine embodying all the best features in Dynamo and Motor Construction.
Dynamos, 15 lights to 250 lights. Motors, ⅛ H. P. to 15 H. P.
ROTH BROS. & CO., Mfrs.
88-92 W. Jackson Street,
Chicago, Ill., U. S. A.

BICYCLE TIRE REPAIRING.—THE Mending of Single Tube Tires.—A practical article illustrating the method of inserting patches and plugs with pliers and pluggers, together with rubber band plugging and the use of puncture bands. 9 illustrations. Contained in SUPPLEMENT **1102.** Price 10 cents. For sale by Munn & Co. and all newsdealers.

SECCOTINE STICKS EVERYTHING. NEVER LETS GO.
Sold by all druggists, department stores, etc., or send 15c. stamps, for sample tube to
AMERICAN AGENCY,
1015 Wool Exchange, N. Y.

Buy Telephones
THAT ARE GOOD—NOT "CHEAP THINGS."
The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **both good.**
WESTERN TELEPHONE CONSTRUCTION CO.
250-254 South Clinton St., Chicago.
Largest Manufacturers of Telephones exclusively in the United States.

PIERCE VAPOR LAUNCHES
Stock Sizes 14 to 22 foot.
Safe, Reliable and fully guaranteed.
Prices $160 and up. Send for Catalogue, PIERCE ENGINE CO., 17 N. 17th Street, Racine, Wis.

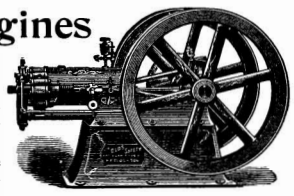
Our Folding Boats are puncture proof. Galvanized steel ribbing. For hunting, fishing, exploring and family pleasure. Walter Wellman took them on his polar trip. Lieut. Schwatka explored the Yukon with them. Awarded first premium at World's Fair. Send 6 c. for catalogue. 40 engravings. **KING FOLDING CANVAS BOAT CO., Kalamazoo, Mich.**

PALMER BROS., **PALMER** Stationary and Marine Gasoline Engines and Launches, Motor Wagon Engines, Engine Castings, Pumping Engines. Send for catalog.
MIANUS, CONN.

IF YOU ARE GOING TO BUY
TELEPHONES

it pays you to buy the best. We make them. Prices, **$2.50** to **$14.00.** Switchboards, **$1.50** to **$3.00** per drop. Guaranteed to give satisfaction and free from infringement.
STONE CITY TELEPHONE MFG. AND CONSTRUCTION CO., JOLIET, ILL.

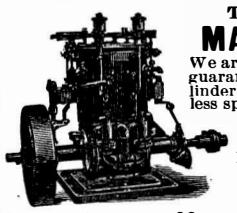
Olds Engines



in small sizes need no gasoline connections, they are all made, no separate reservoir, a temporary supply is in air-tight base. Olds Engines are the simplest and surest.
Olds Gasoline Engine Works, Box 418, Lansing, Mich.

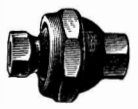
"American-Hunnings" TELEPHONES.

Transmitters, Magneto Bells and Telephone Switchboards. Over **200,000** of our telephones in successful operation. Used by War and Navy Departments. In ordering state length of line, whether single line or metallic circuit and number of telephones to be used on one line. ☞ *Send for catalogue "S. A."*
AMERICAN ELECTRIC TELEPHONE CO., 173 South Canal St., Chicago, Ill.



THE IMPROVED MARINE ENGINE
We are the oldest builders and guarantee superiority. Two cylinders in one casting. Occupies less space and weighs less for its power than any engine made. Can be used wherever power is required. Either stationary or marine. No fire, no heat, no smoke. No licensed engineer required. *Send for cat.*
SINTZ GAS ENGINE CO., Grand Rapids, Mich., U.S.A.

MORAN FLEXIBLE JOINT
for Steam, Air or Liquids.
Made in all sizes to stand any desired pressure. *Send for reduced price list.*
Moran Flexible Steam Joint Co., Inc'd
147 Third Street, LOUISVILLE, KY.

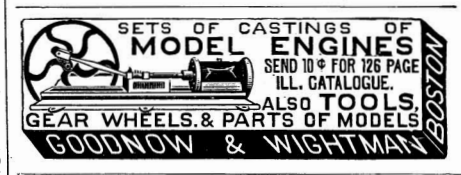


SCREW-CUTTING DIE HEADS
SELF-OPENING and ADJUSTABLE.

The best die head on the market. Some advantages over "others," viz.: They are smaller, stronger, more compact, have no levers to spring, cannot be clogged by chips, are always reliable, and the prices are right. ☞ *Send for descriptive circular "S. A."* Our die heads are furnished in sizes suitable for cutting threads from No. 17 wire gauge to 6 inches diameter inclusive.
GEOMETRIC DRILL CO., WESTVILLE, CT
EUROPEAN AGENTS: CHAS. CHURCHILL & CO., London, England, WHITE, CHILD & BENEY, Vienna, Austria

DO YOU USE GRINDSTONES?

If so, we can supply you. All sizes **mounted** and **unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue.*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.



NEW IDEA IN TRUNKS
The **Stallman Dresser Trunk** is constructed on new principles. Drawers instead of trays. A place for everything and everything in its place. The bottom as accessible as the top. Defies the baggage smasher. Costs no more than a good box trunk. Sent C. O. D. with privilege of examination. Send 2c. stamp for illustrated catalogue. **F. A. STALLMAN,**
61 W. Spring St., Columbus, O.

Planning the New Home

Anyone contemplating the building of a new home will find the
Building Edition of the Scientific American
of peculiar and absorbing interest. This beautiful publication is issued monthly, and contains practical articles and suggestions on modern house building, together with a series of splendid plates, showing perspective views and floor plans of the most up-to-date modern dwellings, estimated cost, etc. A single issue of this handsome periodical is often worth the year's subscription price to the intending builder. Write to-day and send 25 cents for a single copy, or $2.50 for annual subscription.
MUNN & CO., Publishers, 361 Broadway, New York.

© 1899 SCIENTIFIC AMERICAN, INC.

TAUGHT BY MAIL.
ELECTRICAL ENGINEERING,
Telephony, Telegraphy, X-Rays,
MECHANICAL ENGINEERING,
Elementary Mathematics,
MECHANICAL DRAWING,
Etc. Thousands are successful and gaining better positions and salaries studying at home by our correspondence system.
The Electrical Engineer Institute of Correspondence Instruction,
Dept. A, 120-122 Liberty St., New York.

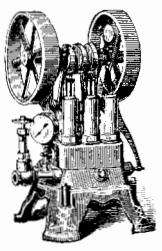
I consider the Electrical Engineer Institute conducted by Messrs Wetzler and Martin to be of great value to those who desire an Electrical education. Thomas A. Edison

Write for Catalogue.
State Subject You Wish to Study

BLISS ELECTRICAL SCHOOL,
711 14th Street, Washington, D. C.
Practical Electrical Engineering thoroughly and exclusively taught. Course opens Sept. 27. Catalogue on application to **L. D. BLISS, Principal.**

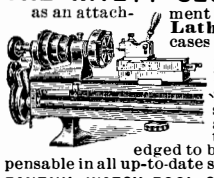
Worcester Polytechnic Institute,
WORCESTER MASS.
Courses of study in Mechanical, Civil and Electrical Engineering and Chemistry. 195-page catalogue, showing appointments secured by graduates, *mailed free. Expenses low. Thirty-second year.* J. K. Marshall, *Registrar.*

JOHNS HYDRAULIC ENGINE



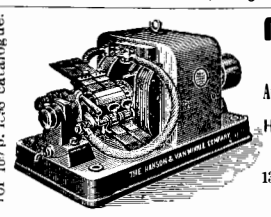
develops all the power which the weight and momentum of water afford—greater than the ordinary water motor or Turbine wheel. It utilizes the stored pressure of the air and it is a remarkably effective machine. Uses less water and develops greater power than any other engine. Occupies but little space and is easy to set up. Requires little care. Is simple and durable. Built in all sizes from ¼ h. p. up to any h. p. desired.
Free descriptive illustrated catalogue.
ELMIRA MFG. CO., 159 Greenwich Street, NEW YORK.

THE RIVETT SLOTTER



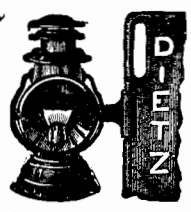
as an attachment to our 8-inch **Precision Lathe** is exceedingly useful in cases where it is necessary to put a key-seat in as small a hole as a cutter may be made to stand the work. From 40 seconds to 2 minutes suffices to put a key-seat in a hole ¼ in. diameter and ¼ in. long—it depends on the metal. This is acknowledged to be a most valuable tool, indispensable in all up-to-date shops throughout the country.
FANEUIL WATCH TOOL CO., Brighton, Boston, Mass.

Send your business card for 1898 catalogue.



NICKEL AND Electro-Plating
Apparatus and Material.
THE Hanson & VanWinkle Co.,
Newark, N. J.
136 Liberty St., N. Y.
30 & 32 S. Canal St Chicago.

TUBULAR DRIVING LAMP.
IT is the only perfect one.
IT will not blow or jar out.
IT gives a clear, white light.
IT is like an engine headlight.
IT throws the light straight ahead from 200 to 300 ft.
IT burns kerosene,
Send for book (free).



R. E. DIETZ CO., 60 Laight Street, New York.
Mention this paper and get special discount.
—ESTABLISHED 1840.—

If You Want the Best Lathe and Drill CHUCKS
BUY WESTCOTT'S *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*

Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

Powerful, Responsive, Durable and Efficient.

REEVES'' Variable Speed Counter Shaft
for securing any speed without change of belt or loss of time. Specially adapted for all kinds of experimental machinery, Printing Presses, Motor Carriages, Ironworking Tools, Woodworking Machinery, or any and all machines requiring a change of speed or feed.
Send for handsomely illustrated Catalogue "S. A." free.
REEVES PULLEY CO., Columbus, Ind., U. S. A.

Reversible **LINENE** Collars and Cuffs.
Stylish, convenient, economical. Made of fine cloth, finished in pure starch, and exactly resemble fashionable linen goods.

No Laundry Work
When soiled discard. Ten Collars or five pairs of Cuffs, 25cts. *By mail, 30cts.* Send 6 cts. in stamps for sample collar or pair of cuffs. Name size and style.
REVERSIBLE COLLAR CO., Dept. J, Boston, Mass.

A $5 PRINTING PRESS
will print your cards, labels etc. Saves you money. Large circular press $18. Full printed instructions for use. *Catalogue and samples free.*

KELSEY & CO., Mfrs., Meriden, Conn.

Tag, memorandum, Scott & Cameron	629,616
Telegraph sounder, J. S. Baynard	629,645
Textile piece goods, ticket holder for application to blocks for, H. Haine	629,560
Thawing frozen earth, etc., heater for, C. P. Brown	629,740
Thill coupling, W. H. Bowe	629,488
Thread case, W. H. Huxford	629,367
Tile, W. Cartwright	629,337
Tire for bicycles or similar vehicles, Silkman & Sexton	629,528
Tire, wheel, J. F. & L. Gommeret	629,745
Tires to vehicle wheels, means for securing, J. H. Glew	629,677
Tires, valve for bicycle, T. Harrison	629,561
Tobacco pipe, Worthington & Williams	629,535
Tobacco treating apparatus, A. V. Hysore	629,368
Tongue support, W. W. G. Hurt	629,721
Top, spinning, G. W. MacKenzie	629,382
Towel rack, H. C. McDonald	629,458
Toy, J. Q. Brown	629,653
Train order holding device, Z. Merideth	629,455
Trimming making machine, H. T. Loomis	629,451
Tripod, photographic, W. H. Lewis	629,379
Trough. See Feed trough.	
Truck, car, C. A. Boyd	629,333
Tube expanding device, F. G. Hampson	629,354
Turbine, F. Prasil	629,700
Type casting machine, C. R. Murray	629,751
Typewriter copy holder, G. S. Gallagher	629,744
Typewriter's rack bar, E. L. Fearing	629,717
Typewriting machine, C. N. Faay	629,437
Typewriting machine ribbon mechanism, C. N. Fay	629,438
Umbrella cover fastener, G. M. Brown-Westhead	629,541
Valve, check, J. J. Locke	629,449
Valve regulator for smoke consumers, C. E. Briney	629,489
Valve, water tank outlet, R. M. Paul	629,464
Vapor burner, H. M. Hamrick	629,356
Vapor burner, incandescent, F. A. Cortis	629,432
Vaporizer B. S. Palmer	629,390
Varnish and producing same, drying, A. P. Bjerregaard	629,331
Varnish, making, A. P. Bjerregaard	629,329
Varnishes, imparting drying properties to, A. P. Bjerregaard	629,330
Vehicle, motor, L. J. Phelps	629,521
Vending machine, J. G. Hollands	629,505
Vessel cover and fastening for same, B. G. Call	629,545
Violin, J. C. Kindig	629,374
Vise for holding threaded nipples, F. Kuttler	629,747
Wagon brake, C. A. Beckstrom	629,646
Wagon brake, J. Stromeyer	629,403
Wagon standard, J. N. Smith	629,618
Waist, T. B. Fitzpatrick	629,439, 629,440
Wall, Stowell & Cunningham	629,477
Washer. See Barrel washer. Gas washer.	
Washing machine, W. F. Stricker	629,702
Washing machine, W. Sweet	629,625
Water closet, J. Old	629,462
Water gate, non-clogging, P. K. Shaffer	629,725
Water, purifying, J. Wilson	629,409 to 629,411
Water purifying apparatus, E. A. Leland	629,577
Water purifying means, E. Maginn	629,578
Water supply for buildings, E. A. Leland	629,576
Water wheel, turbine, W. M. Mills	629,457
Weed and trash cutter for hoe and lister drills, E. W. Griffiths	629,559
Wheel. See Fifth wheel. Water wheel.	
Wheel, Goeke & Knaack	629,442
Whiffletree, E. T. Harlow	629,681
Window, C. W. Bolton	629,419
Window fastener, W. S. James	629,446
Wood, antifouling coating for, G. D. Coleman	629,427
Work bench, V. E. Taylor	629,405
Zinc from its ores, extracting, C. Hoepfner	629,686
Zinc or other metals, electrolytical production of, C. Hoepfner	629,685

DESIGNS.

Bandage, abdominal, D. D. McClure	31,293
Bath seats, supporting member for, O. Cabana, Jr.	31,288
Brushes or similar articles, back for, Crees & Court	31,273
Button hooks or similar articles, handle for, Crees & Court	31,274
Clothes pin, L. E. Karnes	31,290
Corset, M. M. Mills	31,292
Desk standard, school, H. L. Hall	31,287
Fencing tool, E. Anderson	31,282
Furniture leg, J. T. Kitchen	31,289
Game or puzzle board, W. C. Breitenbach	31,295
Hinge staple, W. R. White	31,281
Lantern bracket, H. B. Arnold	31,250
Money box, C. A. Bailey	31,275
Piano plate, J. Dierdorf	31,277
Pitcher or similar article, A. B. Evans	31,284
Ribbon spool rack, H. B. Moore	31,291
Sole, outer, J. W. Fuller	31,294
Speculum member, T. H. Bly	31,278
Stamps, cushion for hand, J. A. Heany	31,276
Stone dressing tool handle, J. Dobbie	31,283
Syringe, C. J. Davol	31,279
Tail cover, W. McClellan	31,285
Watering trough, W. U. Snyder	31,286

TRADE MARKS.

Axes and other edge tools, Supplee Hardware Company	33,283
Beer, lager, Pabst Brewing Company	33,264
Beer, root, E. A. Zatarain	33,265
Beverages, certain named, H. P. Finlay & Company	33,266
Canned groceries except olives, S. Hamill Company	33,272
Cigarettes, American Tobacco Company	33,263
Clothing, certain named, S. N. Wood & Company	33,261
Coffee, roasted, F. R. & W. A. Yerxa	33,269
Finger ring gages, Sussfeld, Lorch & Company	33,260
Fish, Harvey & Outerbridge	33,273
Flour, wheat, firm of Patrick H. Sheehy	33,271
Fuel, artificial, Petolite Fuel Syndicate	33,276
Hardware, certain named articles of, Gray & Dudley Hardware Company	33,282
Leather dressing, waterproof, Waterwax Manufacturing Company	33,274
Liniment, W. E. Mellor	33,279
Lotion, face, Arista Manufacturing Company	33,277
Medical compounds and applications for the skin, C. R. Burrage	33,278
Milk, condensed, Wisconsin Condensed Milk Company	33,267, 33,268
Pills for certain named diseases, W. O. & R. G. Barclay	33,280
Remedies for certain named diseases, firm of C. Raspe	33,281
Rubber, chemical composition, a substitute for Bard, Stahl & Straub	33,275
Starch, Starke-Zucker-Fabrik-Actien Gesellschaft, vorm. C. A. Kohlmann & Company	33,270
Underwear, certain named ladies', Worcester Corset Company	33,262

LABELS.

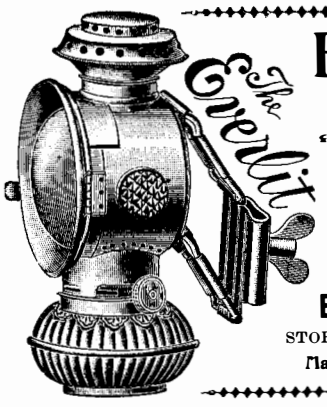
"Cafe Savoy," for canned coffee, C. Biele	7,046
"Dr. Hand's Condensed Milk with Phosphates and Hypophosphites Added," for condensed milk, D. B. Hand	7,047
"Natural Apricots," for canned goods, United States Printing Company	7,048
"Natural Cherries," for canned goods, United States Printing Company	7,050
"Natural Peaches," for canned goods, United States Printing Company	7,049
"Parisian Perfumed Ink," for perfumed inks, National Chemical Company	7,045
"Rocky Ford Cantaloupes," for cantaloupes, H. Woods	7,051
"Yellow Pine Compound," for a medical compound, Yellow Pine Extract Company	7,044

PRINTS.

"Glauber's High Grade Brass Goods," for plumbers' supplies, Glauber Brass Manufacturing Company	155
"Repetti," for confectionery, C. Repetti	154

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

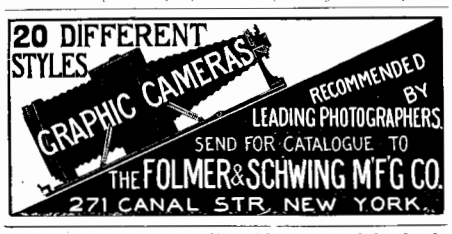
Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.



Bicyclers Buy The Best.
Ever hear of the "Light That Failed"? Most wheelmen have experienced this with their lamps before they began to use the
"EVERLIT" BICYCLE LAMP
No disappointment, no light failing them. The "Everlit" is reliable in every way. It is all brass except hanger, is 5¾ inches high, weighs 13 ounces. It is easy to clean, easy to regulate. The flame can be regulated from either side of lamp. Embossed fount packed with cotton. Burns kerosene oil. This lamp always gives a clear, steady, penetrating light. Fine nickel finish.
Illustrated Catalogue "S. A." free for asking.
Edward Miller & Co. Factories and Salesrooms. **Meriden, Conn.**
STORES: 28 & 30 West Broadway, NEW YORK. 63 Pearl St., BOSTON.
Manufacturers of "Royal" Bells and "Majestic" Gas Lamps.

Dealers in Wheels
and those who rent them to possible buyers, should be particular to have them in good condition, with an easy and smooth running chain that insures comfort and satisfaction to the rider, and a minimum wear and expense to the dealer.
DIXON'S CYCLE CHAIN GRAPHITE
is the best possible lubricant for bicycle chains. It is easily applied and is conveniently packed. For home use or repair shops equally convenient.
Send for Circulars and prices.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

ALL WHEELMEN WEAR
The Pace Maker Foot Clip and Pedal Balancer. Neat, strong, durable. Will adjust to any shoe. Price Foot Clips, 50c. Pedal Balance, 15c. Made only by **RACINE TOE CLIP MFG. CO., Racine, Wis.**
Samples sent postpaid on receipt of regular retail price.


20 DIFFERENT STYLES
GRAPHIC CAMERAS
RECOMMENDED BY LEADING PHOTOGRAPHERS.
SEND FOR CATALOGUE TO
THE FOLMER & SCHWING M'F'G CO.
271 CANAL STR. NEW YORK.

TO LEASE Valuable copper mining lands. F. G. Grove, Luray, Va.

MATCH FACTORY.—DESCRIPTION of an English factory. SCIENTIFIC AMERICAN SUPPLEMENT 1113. Price 10 cents. For sale by Munn & Co. and all newsdealers.

PROPOSALS.
NOTICE IS HEREBY GIVEN THAT THE COMMON Council of Tempe, Arizona, will receive specifications and estimates for the cost and construction of Water Works for the Town of Tempe, until 12 o'clock, noon, September 1, 1899. The Council reserving the right to reject any and all specifications and estimates.
All communications must be addressed to
F. M. SCHUREMAN, Town Clerk, Tempe, Ariz.

Machinery, Tools, Dies, Metal Work designed and constructed. Ernst, 765 Summit Ave, Jersey City, N. J.

MODELS & GEARS CATALOGUE FREE. UNION MODEL WORKS 193 CLARK CHICAGO.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

EAR TRUMPET, $1.00 POSTPAID. Crane Bros., Linenoid Manufacturers, Westfield, Mass.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery. E. V. Baillard, 106 Liberty St., New York.

STEEL TYPEWRITER TYPE
TYPE WHEELS. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

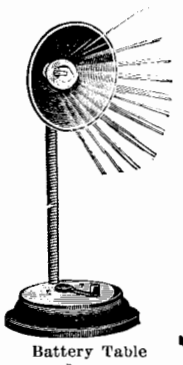
TURBINES Send for Circular "M." JAS. LEFFEL & CO. Springfield, Ohio, U. S. A.

¼ H. P. Electric Motors, $15 to $25. Bench ¼ Speed Lathes, $7. COLUMBIA MFG. CO., 814 Walnut Street, Philadelphia, Pa.

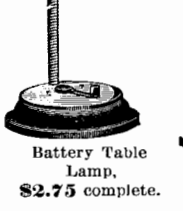
GAS AND GASOLINE ENGINES WATER MOTORS
BACKUS WATER MOTOR CO. NEWARK N. J. U. S. A.

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N. Y.

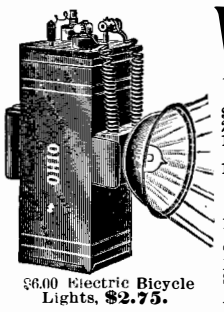
We Are Selling



Necktie Light.



$1.00 Motor.



$6.00 Electric Bicycle Lights, **$2.75.**

Battery Table Lamp, **$2.75** complete.

$3.00 Electric Bell Outfits for	$1.00
21.00 Telephones, complete, for	5.95
12.00 Fan Motors, with Batteries	5.95
8.00 Electric Hand Lanterns for	3.00
10.00 Electric Carriage Lights for	3.95
8.00 Medical Batteries for	3.95
5.00 Electric Belts, the genuine	1.00
3.00 Necktie Lights, for	1.50
14-Candle Hanging Lamp, with Battery, for	10.00
Telegraph Outfits, complete, for	2.25
Miniature Electric Lamps for	.40
Sewing Machine Motors for	5.00

All Electrical Books at low prices.
We Undersell All on Everything Electrical.
OHIO ELECTRIC WORKS, CLEVELAND O.
Headquarters for Electric Novelties and Supplies.
Agents Wanted. *Send for New Catalogue just out.*

GRINDING MILLS FOR ALL PURPOSES. Bogardus Patent Universal Eccentric Mill. Address **J. S. & G. F. SIMPSON, 28 Rodney Street, Brooklyn, N. Y.**

FIRE ESCAPES.
Patent No. 629,228, described on page 92 of this issue of the SCIENTIFIC AMERICAN, for sale outright or on royalty. For particulars address, J. D. AGUILAR, P. O. Box 68, or 304 Washington Street, Brooklyn, N. Y.

50 YEARS' EXPERIENCE
PATENTS
TRADE MARKS
DESIGNS
COPYRIGHTS &C.
Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents.
Patents taken through Munn & Co. receive *special notice*, without charge, in the
Scientific American.
A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.
MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

TO INVENTORS. Wanted—a clock capable of running a counter at irregular intervals and keep good time. Address E. NICHOLSON, Lakewood, Ohio.

WANTED—Machine Tools and Foundry Equipment. $50,000 to invest at once in new and second-hand tools. Address R. E. O. W., care SCIENTIFIC AMERICAN.

NO FROZEN WATER PIPES with Troy temperature-controlled stop and waste. Only simple, practical device. Thoroughly tested and broad patent. For sale or royalty. D. W. TROY, Montgomery, Ala.

STEEL STAMPS FOR MARKING TOOLS &C. NAME STAMPS 10¢ PER LETTER. FIGURE & ALPHABET SETS AT LOWEST PRICES. BEST STEEL. ALL WARRANTED. SEND FOR CIRCULAR. SCHWAAB STAMP & SEAL CO MILWAUKEE WIS.

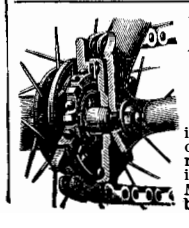
NOVELTIES & PATENTED ARTICLES
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St., Cleveland, O.

Who Rules the World in 100 Years?
PANTERRA will tell. Something entirely new. A novelty. Mailed, prepaid, 25 cents. Agents wanted. Industrial Trading Co., 47 Beaver St., New York.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE R. I.

INVENTIONS WANTED. Wishing to add a few desirable lines to our business we would be pleased to hear from persons desiring to have novelties or patents manufactured on royalty. Will furnish best of reference. Rejected designs will not be returned unless sufficient postage is inclosed. Addr. J. NEHL, Main & Dock Sts., St. Louis, Mo.

YOU CAN MAKE $100. A WEEK!
OWN YOUR OWN SHOW, COMPLETE OUTFIT—$100.
LIFE MOTION FILMS & MACHINES.
GREAT PASSION PLAY & 500 OTHER SUBJECTS
ILLUSTR. CATALOGUE FREE.
S. LUBIN, LARGEST MFR. PHILADELPHIA P.A.



BEST BICYCLE BRAKE
All cyclists, whatever wheel they ride, should have attached the **Latest and Best Automatic Coaster and Brake.**
THE TREBERT BRAKE
is composed of a friction disk secured to the hub of rear wheel, a clutch on the disk and a clutch on the rear sprocket wheel. Both clutches have inclined surfaces upon which balls roll. When the bike chain is pulled forward, the balls also move forward and ride up their incline. Back pressure to pedals produces reverse motion. Free booklet of particulars.
Made only by the **Trebert Automatic Coaster and Brake Co.** SYRACUSE, N. Y.

© 1899 SCIENTIFIC AMERICAN, INC.

THOROUGH INSPECTIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY

STEAM BOILER EXPLOSIONS

J. M. ALLEN, PRESIDENT — W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY — F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, ASST TREAS. — L. F. MIDDLEBROOK, ASST SEC'Y

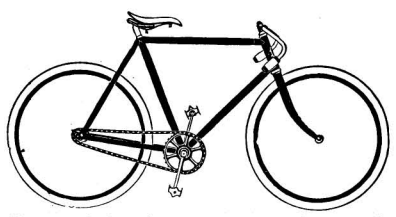
WALTHAM WATCHES

The best and most reliable timekeepers made in this country or in any other.

The "Perfected American Watch," an illustrated book of interesting information about watches, will be sent upon request. American Waltham Watch Co., Waltham, Mass.

LATHES Foot Power, High Grade W. P. Davis Mach. Co., Rochester, N.Y.

A MILE A MINUTE ON A Tribune Bicycle!

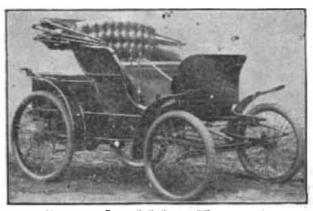


Yes even in less than a minute was the marvelous time made by C. M. Murphy on a Tribune Blue Streak, Model 450, paced by a locomotive. No bicycle has ever been ridden as fast as a Tribune. It is the best and fastest wheel in the world.

Write for Catalogue.

The Black Mfg. Co., Erie, Pa.

Exhilarating Exercise



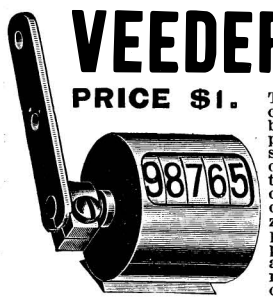
Price $1,000. *No Agents.*

Healthy and pleasurable, for young and old of either sex, is furnished by the WINTON MOTOR CARRIAGE the newest kind of vehicle. It runs swiftly and easily. Can be operated by a grown boy. Perfectly safe. Speed controlled by driver at will. Hydro-carbon system. Full particulars sent free on application to

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.

VEEDER RATCHET COUNTER

PRICE $1.



This counter is of the same size as our regular cyclometer for bicycles, which it closely resembles. The differential gearing used in the cyclometers is replaced by an internal ratchet mechanism, and on the outer end of the main shaft, in place of the star wheel, is clamped a small operating lever, the arrangement being such that each complete oscillation of the lever moves the right hand index ring one figure. The transmitting mechanism between each index ring is such that the rings are mechanically locked and cannot get out of position by jarring, nor can the record be tampered with except by taking the machine apart. The counter will register up to 99,999, when the next stroke will set all the figures to zero ready for repeating, but they cannot be set to zero from any intermediate point. They are durable and strong and can be run at a high speed without skipping. They will be found especially useful for use on punch presses, looms and automatic machinery generally to register number of pieces or quantity of material produced. They can also be adapted for use on typewriters, voting machines, or any purpose requiring a small, light, accurate instrument. *Corresp. solicited.*

THE VEEDER MFG. CO.

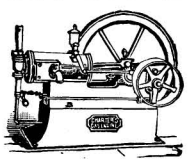
Makers of Counting Machines, Cyclometers for Bicycles, and fine Castings. HARTFORD, CONN., U. S. A

"PEGAMOID" TRADE MARK
ALUMINUM PAINT.

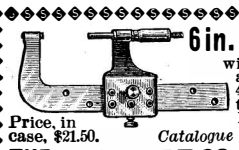
Latest application of Aluminum. Looks like Frosted Silver. Washable, Untarnishable, Water, Oil and Weatherproof. Durable, Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors. Apparatus, Arc Lamps, Sockets, Brackets, Cars, Stations, General Decoration, etc. Sample bottle, by mail, for 25 cents.

THE AMERICAN PEGAMOID CO., 346 B'way, New York.

Founders and Machinists have been using the Charter Gas and Gasoline Engine



so many years its reputation for Economy, Reliability, Safety, etc., is thoroughly established. Proof by addressing CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.



6 in. MICROMETER will measure by thousandths round work to 4½ in. and flat work to 6 in. Weighs 21 oz. Is rigid and accurate. Price, in case, $21.50. *Catalogue of Fine Tools free.*

THE L. S. STARRETT CO. Box 13, Athol, MASS. U. S. A.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes Sewing Machines, Bicycles, Tools, etc Save Money. Lists Free. CHICAGO SCALE CO., Chicago. Ill.

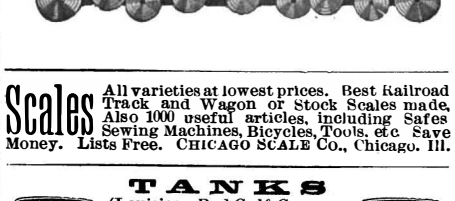
REISCH'S FOOT POWER EMERY WHEEL

KNIFE SHARPENER and TOOL GRINDER.

2,000 revolutions or 3,500 feet per minute. A handy machine for bicycle repair shops, machine shops, mills, factories, etc. Height of machine, 3 feet; size of emery wheel, 6x1 in.

☞ Machine sent on approval to responsible parties. *Send for Circular and Prices.*

BUFFALO EMERY WHEEL CO., No. 10 Lock Street, Buffalo, N. Y.



THE COLUMBIA BEVEL-GEAR CHAINLESS

is pre-eminently the wheel for women. The picture shows its manifest advantages. Nothing to catch or soil the skirt; no unsightly chain guard to work loose and rattle; no sprockets to entangle guard lacings. The rigid frame construction overcomes that tendency to spring or "whip" which is the common fault of other drop frame machines. There is no good reason why a woman as well as a man should not have a bicycle of the highest efficiency—no good reason why most women should not have a Columbia Chainless when we sell **Model 51 for $60 and Model 60 for $75.**

Columbia Bevel-Gear Chainless wheels for men and women are the easiest running, most durable and cleanest bicycles, because the driving mechanism, which is positive in its action, is supported by perfectly rigid frame construction, and so enclosed that its running qualities cannot be affected by dust, mud or rain.

CHAIN WHEELS:
COLUMBIAS, HARTFORDS AND VEDETTES, $25 TO $50.

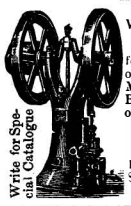
POPE MANUFACTURING CO., Hartford, Conn.

TANKS (Louisiana Red Gulf Cypress a Specialty.) Best known for every purpose. Good material Correct Workmanship. Low Prices. *Get our Illustrated Catalogue.* W. E. Caldwell Co. 223 E. Main St., Louisville, Ky.

Patent, covering a satisfactory pendulum, temperature compensation, adaptable to existing types, for sale on reasonable terms. Consists simply of a short ebonite collar. Costs to manufacture cents instead of dollars. Apply, E. K. A., Room 4, Floor 4, 15 Broad St., N. Y. City

GARDNER DIE STOCK
GOOD GOODS CHEAP
C. H. BESLY & CO 1012 N. CANAL ST. CHICAGO ILL. U.S.A.
SEND FOR CATALOGUE

REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No, **1158.** Price 10 cents, by mail, from this office, and from all newsdealers.



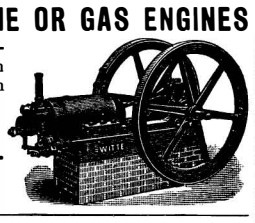
This beats Wind, Steam, or Horse Power. We offer the WEBSTER 2½ actual horse power GAS ENGINE for $150, less 10 per cent discount for cash. Built on interchangeable plan. Built of best material. Made in lots of 100 therefore we can make the price. Boxed for shipment. weight 800 lbs. Made for Gas or Gasoline. Also Horizontal Engines, 4 to 30 h. p.

Write for Special Catalogue

WEBSTER MFG. CO., 1074 West 15th St., Chicago.

Eastern Branch: 38-D Dey Street, New York City. Southern Agents: Boland & Gschwind Co., Ltd., So. Peter and Lafayette Sts., New Orleans, La.

WITTE GASOLINE OR GAS ENGINES are Safe, Reliable, Durable and Simple. Sold on their merits and sent on trial if desired.



Write for Catalogue S. A.

WITTE IRON WORKS CO. 1207 Walnut St., Kansas City, Mo.

There is no Kodak but the Eastman Kodak.

Kodak

Simplicity and Kodak Quality created the standard by which all cameras are measured.

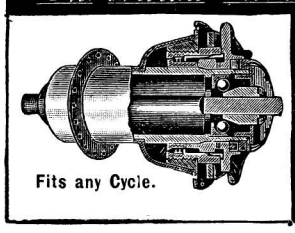
That's why the clerk says: "It's as good as a Kodak," when trying to sell an inferior camera.

Kodaks $5.00 to $35.00.

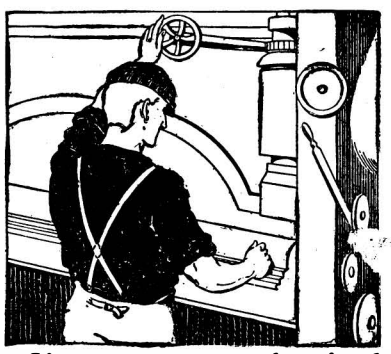
Eastman Kodak Co.,

Kodak Catalogues free of dealers or by mail. Rochester, N. Y.

What Wheel Is Yours? No matter what make, have it fitted with The Morrow Automatic Hub Coaster and Brake. Ride 50 miles and pedal only 35. Feet always on pedals. Wheel always under perfect control. For sale everywhere, or sent by Express prepaid on receipt of price $7.00. Guaranteed for one year. Eclipse Bicycle Co. Box X. Elmira N. Y.



Fits any Cycle.



If you want a galvanized iron to make a good job and save wages—Apollo.

Apollo Iron and Steel Company, Pittsburgh.

PHOTOGRAPHY IN COLORS—FORmulas for producing photographs in colors by the Chassagne process. SCIENTIFIC AMERICAN SUPPLEMENT, Nos **1114** and **1125.** Price 10 cents each, by mail, from this office and from all newsdealers.

FOR SPORTSMEN

hunting, fishing, camping or yachting. May be laid on ground or deck insuring a comfortable bed, free from dampness. When deflated, rolls small and can be packed in grip. Weight 10 to 15 lbs., according to size.

These mattresses afford great comfort to invalids and bedridden patients. Largely used by U. S. Government and by sportsmen throughout the world. *Catalogue free*

MECHANICAL FABRIC CO., PROVIDENCE, R. I.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC. Wm JESSOP & SONS Lᵗᵈ 91 JOHN ST. NEW YORK

Experimental Science

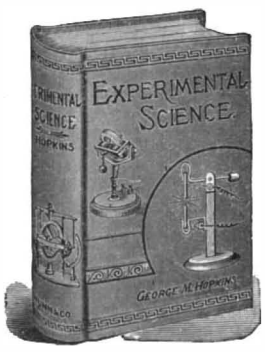
By GEO. M. HOPKINS.

20th Edition Revised and Enlarged.

914 Pages, 820 Illustrations.

Price $4.00 in cloth; $5.00 in half morocco, postpaid

THIS is a book full of interest and value for Teachers, Students, and others who desire to impart or obtain a practical knowledge of Physics. This splendid work gives young and old something worthy of thought. It has influenced thousands of men in the choice of a career. It will give anyone, young or old, information that will enable him to comprehend the great improvements of the day It furnishes suggestions for hours of instructive recreation.



Send for large Illustrated Circular and complete Table of Contents.

MUNN & CO., Publishers, Office of the SCIENTIFIC AMERICAN, 361 BROADWAY, NEW YORK.

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane. New York

THE HARRINGTON & KING PERFORATING CO.
PERFORATED METALS OF EVERY DESCRIPTION FOR ALL USES. STATION F CHICAGO.

© 1899 SCIENTIFIC AMERICAN, INC.